Registered at the G.P.O. for Transmission to Canada by Magazine Post.

VOL. 41. Ser. A. Part 8. pp. 225–256. AUGUST, 1953.

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

Price 4s. net (0.60 Can. or U.S. dollars).

All Rights Reserved.

Commonwealth Agricultural Bureaux

EXECUTIVE COUNCIL.

E. Marsden, C.M.G., C.B.E., M.C., D.Sc., M.I.E.E., F.R.S., *Chairman*, New Zealand.

W. F. C. Morton, *Vice-Chairman*, Union of South Africa.

C. H. M. Wilcox, M.A., United Kingdom.

Lieutenant-Colonel J. G. Robertson, B.S.A., F.R.S.A., Canada.

J. E. Cummins, M.Sc., F.R.I.C., Australia.

H. E. The High Commissioner for India, India.

S. D. Muzaffar, M.A., M.Sc., Ph.D., F.R.S.A., Pakistan.

J. E. C. Coventry, B.A., M.Sc., Southern Rhodesia.

H. E. The High Commissioner for Ceylon, Ceylon.

C. E. Lambert, C.M.G., Colonial Territories.

Sir Herbert Howard, *Secretary*, Farnham House, Farnham Royal, nr. Slough, Bucks.

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

Director and Editor.

W. J. Hall, C.M.G., M.C., D.Sc.

Assistant Director.

E. O. Pearson, B.A.

Assistant Editor.

H. S. Bushell, M.A.

Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office and Library—41, Queen's Gate, London, S.W.7

MURPHY
INSECTICIDES
and
FUNGICIDES
include

SYTAM
SYSTEMIC INSECTICIDE

Based on schradan, SYTAM has given outstanding control of Aphis and Red Spider on cotton, hops, brussels sprouts and other brassicae, fruit trees, especially peaches, and many other crops. It can be mixed with most sprays in common use, including Bordeaux.

BFPO
BIS (DIMETHYLAMINO) FLUORO-PHOSPHINE OXIDE

Possessing a greater insecticidal activity than schradan, BFPO is fully effective against a wide range of pests, including Mealy Bugs and Scale Insects which schradan does not control. It should only be used for soil application.

WARFARIN

Warfarin is the new scientific rodenticide which will eliminate entire colonies of rats and mice from farm buildings, warehouses, stores and dwellings, and will keep them free from infestation by these pests.

THE MURPHY CHEMICAL COMPANY LIMITED

WHEATHAMPSTEAD · HERTS · ENGLAND

Cables: ALVESCO, Wheathampstead, St. Albans.

THE MEDITERRANEAN FLOUR MOTH

Ephestia kühniella

This moth causes considerable losses to cereals and cereal products in most countries of the world.

It is especially common in flour mills, where the silk webbing spun by the larvae over flour and bran can be so extensive as to choke the machines and chutes through which the flour and bran pass — so that the mill has to be shut down for cleaning.

Ephestia infestations in bags of flour produce sheets of webbing on the bags and in the flour, and may result in 'souring'.

Regular treatments with 'Gammexane' Smoke Generators can keep flour mills practically free from moths.

Kill flour moths with

'GAMMEXANE' Regd. SMOKE GENERATORS

Containing gamma BHC of lindane quality.

Technical advice on the best use of 'Gammexane' sprays, dusts, and smoke generators is freely available on application to:

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

ICI

G.118

Carayon (J.). *Helopeltis* **(Hem. Miridae) nouveaux nuisibles aux quinquinas en Afrique française.**—*Bull. Mus. Hist. nat.* (2) **21** no. 5 pp. 558–565, 2 figs., 6 refs. Paris, 1950.

Cinchona is attacked in the first four years of growth by species of *Helopeltis* in all parts of Africa and Asia in which it is cultivated. The commonest of them in French Africa is *H. schoutedeni* Reut., which is numerous in French West Africa and the French Cameroons and has long been confused with *H. bergrothi* Reut. [*cf. R.A.E.*, A **41** 14], but this species is accompanied, and in certain districts replaced, by others, which increase in numbers with proximity to dense forest. The latter include *H. gerini*, sp. n., and *H. bergrothi* subsp. *lalandei*, n., adults of both sexes of which are described. *H. gerini* was taken in December 1947 on *Cinchona* in a plantation at an altitude of about 5,000 ft. in dense forest at Dschang, French Cameroons, and was abundant in the dry season. Subsp. *lalandei* was taken in 1946 in plantations at altitudes of about 2,500–3,500 ft. at Sérédou, French Guinea, but was not common.

Subsp. *lalandei* has several characters common to various forest forms of *Helopeltis*, of which typical *bergrothi* is one, and though these latter were intersterile in preliminary crossing experiments, intermediate forms were found. The author considers that *H. bergrothi* includes varieties of the typical form, and also subspecies, notably *lalandei* and a common *Helopeltis* that has been referred to as *H.* prox. *rubrinervis* [*cf.* **41** 14, 15] and is here called *H. bergrothi rubrinervis*, though proof of its identity with the true *H. rubrinervis* Popp. will necessitate examination of the type of the latter. The author considers the *Helopeltis* on cacao in the Gold Coast tentatively identified as *H. bergrothi* var. *mayumbensis* Ghesq. [**41** 15] to be subsp. *lalandei*.

The typical form of *H. bergrothi* was not collected on *Cinchona*, in French Africa at least, until July 1949, when numerous examples were found in the plantations at Sérédou. It occurs in forest near *Cinchona* plantations in the Cameroons, but examples transferred to *Cinchona* did not feed. The only other species of *Helopeltis* collected on *Cinchona* in French Africa is *H. westwoodii* (White), which is fairly numerous in forest plantations in French Guinea and less common in the Cameroons.

Risbec (J.). **I. Les Chalcidoïdes d'A.O.F.**—*Mém. Inst. franç. Afr. noire* no. 13 pp. 5–409, 179 figs., 67 refs. Dakar, 1951. **II. Les Microgasterinae d'A.O.F.**—*T.c.* pp. 411–473, 46 figs., 9 refs.

Risbec (J.). **Les Microgasteridae** [sic] **d'A.O.F. (rectifications).**—*Bull. Inst. franç. Afr. noire* **14** no. 2 p. 701. Dakar, 1952.

The first of these publications comprises two further parts of a study of insects associated with crops in Senegal and the French Sudan and their parasites [*R.A.E.*, A **38** 387]. Each comprises a systematic list of parasites with localities, hosts where known, descriptions of new species, distribution and host records from the literature, and keys to the species of a few of the genera. In the first part, 250 species of Chalcidoids, excluding Chalcids, are dealt with, of which most were reared from hosts collected in the Ivory Coast and the French Sudan and the rest were collected there, and of which 201 are described as new. The second part deals with 47 species of Microgasterine Braconids, almost all from Senegal but with a few from the Ivory Coast and the Sudan and one from Madagascar, of which 28 are new. Most of them attack Lepidopterous pests, and a list is given showing the host and its food-plants for 43 species.

(1360) Wt. P9/3884 9/53 E.P. Ltd. Gp. 566. [A]

In the second publication, new names are proposed for three of the new species of *Apanteles*, since the names originally selected proved to be preoccupied.

Downes (J. A.) & Williams (D.). **The Insect Faunas of the dried Roots of *Lonchocarpus* and *Derris*.**—*Colon. Pl. Anim. Prod.* **1** no. 1 pp. 33–51, 2 pls., 50 refs. London, 1950.

The authors give lists of 25 species of Coleoptera, six other insects, a Tetranychid and a pseudoscorpion that were found on dried roots of *Lonchocarpus* (cubé) imported into Scotland from Peru by way of New York, and discuss their mode of occurrence, habits and distribution. The roots had probably been fumigated before shipment, and all the insects were dead, but most of the Coleoptera had been breeding in the roots for a considerable time, and damage was severe. More than 98 per cent. of it was due to *Dinoderus bifoveolatus* Woll., but injury by *Scolytus* (*Eccoptogaster*) *dimidiatus* Chapuis and *Araecerus fasciculatus* (Deg.) was apparently considerable in some of the roots. They also review records of insects found on dried *Derris* roots, largely in Malaya [*cf. R.A.E.*, A **23** 89, etc.], compare the species of this group with those found on *Lonchocarpus*, and discuss the factors influencing the commercial importance of the damage.

Ratcliffe (F. N.), Gay (F. J.) & Greaves (T.). **Australian Termites. The Biology, Recognition, and economic Importance of the common Species.** —$9\frac{3}{4} \times 7\frac{1}{4}$ ins., 124 pp., 21 figs., 22 refs. Melbourne, Commonw. sci. industr. Res. Org. Aust., 1952.

This handbook has been written for those without specialised entomological knowledge and is based mainly on the earlier monograph on Australian termites by G. F. Hill [*R.A.E.*, A **31** 324], but it includes some additional information resulting from observations by the authors. It consists of two parts, of which the first contains general accounts of the habits, biology and economic importance of termites with special reference to those that occur in Australia, a key to the genera of the latter, and information facilitating their identification, and the second contains notes on the distribution, distinguishing characters, feeding and nesting habits and injuriousness of the genera and commoner species found there. An introductory note on termite nomenclature contains a table relating the scientific names used with those adopted in Snyder's catalogue [**39** 452], which was published after the manuscript had been prepared, and there are three appendices, containing a bibliography, brief instructions for collecting termites, and a review of the usual measures for the prevention and control of infestation in buildings and the protection of posts, railway sleepers, etc.

Chant (D.A.) & McLeod (J. H.). **Effects of certain climatic Factors on the daily Abundance of the European Earwig, *Forficula auricularia* L. (Dermaptera: Forficulidae), in Vancouver, British Columbia.**—*Canad. Ent.* **84** no. 6 pp. 174–180, 1 graph, 7 refs. Ottawa, 1952.

The following is largely the author's summary. The effects of temperature, temperature range, wind velocity, relative humidity, atmospheric pressure, range of atmospheric pressure, wind direction and cloud cover on the daily abundance of *Forficula auricularia* L. were studied at Vancouver, British Columbia, during September 1950 from data obtained from daily collections of earwigs sheltering in artificial refuges. The effects of wind direction and cloud cover were not analysed statistically, but they appeared to

have some correlation with earwig abundance in the refuges. In Vancouver, easterly winds are usually accompanied by cloudy weather, and westerly winds by clear weather. The earwigs were most abundant during periods of prevailing easterly winds and least abundant during periods of prevailing westerly winds. When individual graphs were plotted for the other six factors, it was obvious that the range of atmospheric pressure over 24-hour periods had no significant correlation with earwig abundance. The significance of the correlations between the remaining factors and earwig abundance was determined by calculating their individual correlation coefficients. The correlations for atmospheric pressure and relative humidity were not significant, though humidity at 4.30 a.m. showed a close inverse relation with abundance. There was a significant direct correlation with wind velocity and highly significant correlations with temperature and temperature range, which were direct in the case of the minimum daily temperature and the average temperatures for the three-hourly periods between 6 p.m. and 6 a.m., of which that for the period from 3 to 6 a.m. apparently exerted the greatest influence, and inverse in that of the maximum daily temperature and the daily temperature range.

TURICA (A.). **Ciclo biológico y ensayos de métodos de lucha sobre *Carpocapsa pomonella* L. en el Delta.** [The Life-cycle of *Cydia pomonella* and Methods of Controlling it in the Delta of the River Paraná.]—[*Publ. Inst. Sanid. veg.*] *Minist. Agric. Argent.* (A) **5** no. 51, 11 pp., 1 graph, 4 refs. Buenos Aires, 1950.

Observations were made in 1948–49 on the life-cycle of *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple in the delta of the River Paraná, Argentina, in order to determine the correct dates for spraying against the larvae. Bait-traps were suspended in the trees and replenished twice weekly, and bands of corrugated cardboard were placed on the trunks 20 days after the beginning of adult emergence in each generation and the larvae found under them 20 days later reared in cages. Adults of the overwintered generation appeared at the beginning of November, and peak numbers were reached on 10th at maximum and minimum temperatures of 29°C. [84·2°F.] and 11°C. [51·8°F.], respectively, and a relative humidity of 87 per cent. Adults of the first generation, which was the most numerous, appeared in mid-December, and the peak was reached on 18th at maximum and minimum temperatures of 30·5°C. [86·9°F.] and 11°C. and 65 per cent. humidity; 5 per cent. of the larvae of this generation were killed by larvae of *Chrysopa lanata* Banks. Adults of the second generation appeared in the field in mid-February, and the greatest numbers were present on 22nd, when the maximum and minimum temperatures were 35°C. [95°F.] and 12°C. [53·6°F.] and the humidity 70 per cent. Since the development of a third generation depends on climate, eggs laid by second-generation adults were reared in the insectary, and they gave rise to adults after 40–50 days. Some adults emerged in the field at the same time, and emergences continued until cool weather in April.

Of the four baits tested, the most effective was a mixture of malt extract, brewers' yeast and water, and mixtures incorporating geraniol or anethole offered no advantage. Twice as many larvae were found under untreated bands as under those treated with β-naphthol, which had a disagreeable odour. When the bands had been treated with β-naphthol in a cold solution [*cf. R.A.E.*, A **32** 206, etc.], 25 per cent. of the larvae taken from them gave rise to adults, as compared with none for treatment with a hot solution.

Since the eggs of *C. pomonella* hatch within 4–10 days, it is concluded that lead-arsenate sprays should be applied a few days after maximum emergence of the various generations.

LOWER (H. F.). **A Revision of Australian Species previously referred to the Genus *Empoasca* (Cicadellidae, Homoptera).**—*Proc. Linn. Soc. N.S.W.* **76** pt. 5–6 pp. 190–221, 1 pl., 74 figs., 1 map, 19 refs. Sydney, 1952.

This revision is based on examination of all the Jassid collections in Australia and of material collected for the purpose and comparison with type specimens. Seven Australian Jassids have previously been included under various names in the genus *Empoasca*, but one of them, *E. athertoni* Evans [*R.A.E.*, A **30** 154], does not belong to any genus of the *Empoasca* group (for which the term Empoasciti is suggested). The new genus *Austroasca* with two subgenera is erected for the other six, and two new species are described in it. Its type is *A. viridigrisea* (Paoli). The species of economic importance are *A. viridigrisea*, *A. terrae-reginae* (Paoli), *A. alfalfae* (Evans) and *A. histrionicula* (Kirky.). *A. terrae-reginae* breeds only on malvaceous plants and is a major pest of cotton in Queensland; *E. maculata* Evans [**34** 166; **35** 243; **39** 211, 258] is a synonym of it. *A. viridigrisea* breeds on cotton, beet, lucerne, beans, melons and solanaceous crops in coastal districts of Australia and inland on tobacco in Victoria and is the polyphagous pest that has been recorded as *E. terrae-reginae* in the more recent literature [**30** 154, 276; **32** 66; **35** 243, 271; **36** 74, 363; **39** 258]. A record of *E. fabae* (Harr.) on tomato in Queensland [**35** 162] almost certainly refers to *A. viridigrisea*; there is no evidence that *E. fabae* or any other exotic species occurs in Australia. *A. alfalfae*, which occurs in Queensland and New South Wales, breeds on leguminous crops and cotton and has also been found on potato, and *A. histrionicula* breeds on *Sida* spp. in Queensland and has been recorded on cotton there.

In addition to descriptions of the new genus, the subgenera and all the species, the paper includes keys to the adults of both sexes, translations of the original descriptions of *A. viridigrisea* and *A. terrae-reginae*, and tables showing distribution and food-plants.

BRAUN (H.) & RIEHM (E.). **Krankheiten und Schädlinge der Kulturpflanzen und ihre Bekämpfung.** [Diseases and Pests of Crops and their Control.] —7th revd. edn., $9\frac{1}{2} \times 6\frac{1}{2}$ ins. [7 +] 339 pp., 290 figs., 636 refs. Berlin, P. Parey, 1953. Price, cloth, *DM.* 26.80; paper, *DM.* 24.80.

This seventh edition of a handbook on pests and diseases of field crops, fruits and vegetables in Germany differs little from the sixth [*R.A.E.*, A **38** 224], but includes references to a few additional insect pests and many new illustrations. As ornamental plants are not included in the scope of the work, the allusion to garden crops has been dropped from the title.

Transactions of the IXth International Congress of Entomology, Amsterdam, August 17–24, 1951. Vol. I. The Congress, Plenary Sessions, Communications at the Sectional Meetings.—lxi + 1115 pp., illus., refs. Amsterdam, 1952. **Vol. II. Symposia.**—vii + 364 pp., illus., refs. 1953.

The first volume contains the text of the lectures given at plenary sessions and of most of the papers read at sectional meetings, and the second comprises papers forming parts of symposia. The subjects of these

symposia include the physiological relations between insects and their food-plants, regulation of population density in forest insects, epidemiology of tropical and subtropical insects, and organic phosphorus and systemic insecticides. Of the papers in the first volume, those concerned primarily with insect pests occupy some 500 pages. Much of the information in many of them is of general character or has been noticed from other sources, but abstracts of some are given below.

EL ZOHEIRY (M. S.) & ASEM (M. A.). **The Chinese Jute or Hollyhock Moth *Crocidosema plebeiana*, Zell. as an anticipated Cotton Pest,** pp. 472–477, 3 figs. *Crocidosema plebeiana* Zell. has been recorded as a pest of cotton in Queensland [*R.A.E.*, A **31** 265] and Italy [**35** 420], but has been taken on this crop only twice in Egypt, where it normally feeds on hollyhock (*Althaea rosea*). In 1949 and 1950, it was found in the north of the Delta heavily infesting Chinese jute, *Abutilon avicennae* [*cf.* also **20** 622], which was introduced into Egypt about 1920, but neighbouring cotton was not attacked. Galls were formed on the terminal shoots of the infested plants, which were retarded and stunted in growth, developed multiple branching, and produced short fibres and a reduced yield of seed. Species of *Chenopodium*, which are weeds in cotton areas, were also found infested in August 1951. On *A. avicennae*, eggs of *Crocidosema* were laid in clusters of three or four on the aerial parts of the plants, the larvae developed within communal galls, sometimes accompanied by larvae of *Earias insulana* (Boisd.), and development was completed in about a month. Three generations occurred on this food-plant during June–September, and earlier ones on hollyhock. In 1950, effective control was obtained by removing infested plant parts and burning the galls. Sprays containing BHC or DDT protected the young plants, and soaking the galls with carbon bisulphide destroyed the larvae within them. The use of *A. avicennae* as a trap crop for the protection of cotton is recommended.

FERRIÈRE (C.). **Les parasites de *Lyonetia clerckella*,** pp. 593–595. A list is given of 11 species of Chalcidoid parasites reared from fallen leaves collected in February in the Canton of Vaud, Switzerland, under apple trees that had been heavily infested in the previous year by *Lyonetia clerkella* (L.). The four most numerous, which together constituted 76 per cent. of the total, were a species of *Cirrospilus* near *S. vittatus* Wlk., *Omphale* sp., *Achrysocharis* sp. and *Tetrastichus xanthops* (Ratz.). Kemner's conclusion that the fallen leaves harbour useful insects [**14** 612] is thus confirmed, and it is suggested that they should not be removed and should be protected from insecticidal sprays applied in winter.

RIVNAY (E.). **The Threshold of Reproduction in Insects and its Application to Agriculture,** pp. 607–610. The threshold of reproduction in insects is defined as the temperature below which courting, mating and oviposition do not take place. Attempts to estimate it from the relation between temperature and the rate of oviposition or duration of the oviposition period proved unsuccessful, and it was therefore determined for several insects of economic importance in Israel by laboratory rearings under controlled conditions. The results are given for *Clausenia purpurea* Ishii, which is released for the control of a mealybug of the group of *Pseudococcus comstocki* (Kuw.) on *Citrus* [**31** 441], *Capnodis tenebrionis* (L.) and *C. carbonaria* (Klug.), which are pests of stone-fruit trees [**34** 369], and *Ceratitis capitata* (Wied.) [**30** 402], and it is pointed out that in each case the threshold of reproduction is above the threshold of development. The information obtained indicated that *Clausenia* will oviposit as late as November and as early as March (it was observed doing so in the field on a warm day in February), that the number of sprays applied against the

adults of *Capnodis* can be reduced to two (one in early May against the overwintered beetles and another in mid-July against the first generation) and that *Citrus* fruits can safely be exported in autumn without risk of infestation by *Ceratitis*.

Rozsypal (J.). *Dyspessa ulula* **Bkh., ein Schädling von Zwiebelgemüse** [*D. ulula*, a Pest of Onions and Garlic], pp. 656–659, 20 figs. In 1950, larvae of the Cossid, *Dyspessa ulula* (Borkh.), severely injured a field of garlic in southern Moravia. Apart from the damage caused by their feeding, the small surface wounds permitted the entry of various micro-organisms. Adult flight occurred in May–June, and eggs were deposited on the basal parts of the plants. The larvae fed in the bulbs for about 5–6 weeks in June–August and overwintered in cocoons in the soil or in the feeding cavities. They spun fresh cocoons in spring and pupated, and the adults were ready to emerge by the end of May. All stages are briefly described.

Hase (A.). **Die Einbürgerung des Speisebohnenkäfers als Freilandschädling in Deutschland** [The Establishment of *Bruchus obtectus* as a Field Pest in Germany], pp. 666–667. *Bruchus* (*Acanthoscelides*) *obtectus* Say has been known as a pest of stored beans in Germany for about 30 years. During the past ten years, increasing numbers of cases of field infestation have occurred, including some in central Germany [*cf.* **30** 544], and the Bruchid must now be considered an established field pest there. Near Berlin in 1950, 703 adults had emerged by early November from 4,966 beans picked in late August from an experimental plot of a climbing variety; 92 per cent. of them were from those on the lowest 3 ft. of the plants, and infestation was three times as heavy on the south as on the north side. Adults were observed in summer on the flowers at places where bumble bees had injured the calyx in search of nectar.

Bytinski-Salz (H.) & Neumark (S.). **The Eucalyptus Borer** (*Phoracantha semipunctata* **F.) in Israel,** pp. 696–699, 2 figs. Species of *Eucalyptus*, notably *E. rostrata*, are of considerable potential importance in Israel, but they are attacked by *Phoracantha semipunctata* (F.) [*cf.* **41** 219] when five years of age or more. When standing trees are attacked, those less than 12 years of age are completely girdled and usually succumb, but older ones may survive, though rendered susceptible to subsequent infestation. The adults live for about 40 days in summer and 180 in winter. Oviposition ceases when the minimum night temperature falls below 15°C. [59°F.] and is resumed when it reaches 16·2°C. [61·2°F.]. Eggs are laid during March-November in batches of 10–110 under loose bark on standing trees and on the lower surfaces of logs in contact with the soil. The maximum number deposited by single field-collected females in the laboratory was about 300. The threshold for complete development was 11·5°C. [52·7°F.], and the thermal constants for egg, larval and pupal development and for total development to 50 per cent. emergence were 47·5, 885, 525 and 1,566·7 day degrees C. [85·5, 1,593, 945 and 2,802·6°F.], respectively. No effective parasites have been observed. The irregular distribution of the infestation suggests that susceptibility to attack depends on the physiological condition of the trees; almost all those in part of one grove were heavily attacked when irrigation water was diverted from them.

Ceballos (G.) & Zarco (E.). **Sobre el desarrollo y combate en España de la** *Liparis monacha*, **en masas de** *Pinus silvestris* **de las Cordilleras de la Meseta Central** [On the Development and Control of *Lymantria monacha* in Forests of *Pinus sylvestris* in the Central Plateau of Spain], pp. 705–707. (With a Summary in English.) *Lymantria* (*Liparis*) *monacha* (L.) increased considerably in stands of *Pinus sylvestris* in central Spain in 1950–51, and investigations showed that the larvae hatched in May and

pupated in July. In a large-scale experiment on control in 1951, wettable-powder and emulsion sprays of BHC and wettable-powder sprays of DDT were applied from an aeroplane between early June and early July at 2·7 lb. BHC and 2·25 lb. DDT per acre. The treatments gave about 80 per cent. mortality in all. BHC was the more rapid in action, but DDT was the more persistent, especially when followed by rain.

Régnier (R.). **Importance des dégâts de la mineuse du cambium du peuplier pour l'industrie du déroulage,** pp. 711–714, 7 refs. (With a Summary in English.) The manufacture of cheese boxes, for which poplar is employed, is becoming of increasing importance in France. High quality wood is required, especially for the curved sides of the boxes, which are made from strips 0·8 mm. in thickness that readily break if the wood is weakened. A frequent cause of weakness is damage to the cambial zone of the trees by the mining larvae of an Agromyzid the identity of which is uncertain but which causes injury similar to that recorded in Austria for a species of *Phytobia* (*Dendromyza*) [*cambii* (Hend.)] on willow by Schimitschek, who also observed similar damage on poplar [**24** 49–50]. The injury is not detected until the bark is removed. The Agromyzid is especially abundant in marshy districts and attacks trees up to 12 years of age. Oviposition occurs apparently in June, and pupation about July–August, in the soil at the base of the trees. The adults emerge in the following spring and there is one generation a year. Control in the plantations appears difficult, but measures might be taken in the factories to detect damaged wood before manufacture.

Bletchly (J. D.). **A Summary of some recent Work on the Factors affecting Egg-laying and Hatching in** *Anobium punctatum* **De G. (Coleoptera-Anobiidae),** pp. 728–734, 2 figs., 6 refs. The conditions that render wood susceptible to attack by *Anobium punctatum* (Deg.) were investigated in the laboratory in southern England. For experiments on oviposition, strands of coarse cotton were wound round wood blocks cut radially or tangentially in the direction of the grain and small strips of butter muslin were bound over the two ends with more cotton to form a site for the deposition of eggs; access to the sides was prevented by covering them with adhesive tape. It was found in this way that blocks of plywood (beech or pine) made up with blood glue or, to a less extent, hide glue, were preferred to those made up with a synthetic glue (urea formaldehyde). Dissection of females showed that they are capable of laying upwards of 60 eggs, though the numbers actually deposited usually averaged less than 28. The females spend much time in the exit holes, which they re-enter and in which some eggs are laid, and those collected early in the emergence period laid more eggs than those collected later. At 20°C. [68°F.], relative humidities above 56 per cent. had little influence on the duration of the egg stage, but it was somewhat prolonged and viability was decreased at lower humidities [**38** 263]; the relative humidity in dwellings is variable but normally exceeds 56 per cent. during June–August. Temperature had a greater influence, incubation being accelerated by high average temperatures. At 22°C. [71·6°F.] and 76 per cent. relative humidity, about half the larvae established themselves in sound wood, but rather more became established when the wood was partly decayed, especially in the case of beech, and development was more rapid in decayed than in sound wood.

el Mistikawi (Abd el Megid). **Chemical Control of the Cotton Leaf Worm,** *Prodenia litura* **L., in Egypt,** pp. 766–769, 1 fig., 5 refs. In tests in Egypt in 1948, dusts and sprays of DDT, a spray of DDD and a toxaphene dust were more effective against *Prodenia litura* (F.) on cotton than dusts and sprays of BHC, but combinations of DDT and BHC gave even

better control, and plants treated with them showed increased vigour. In similar tests in 1949, sprays containing 0·1 per cent. DDT gave complete mortality, and a dust of 10 per cent. DDT and 3 per cent. γ BHC only 95 per cent., but the dusted plants were taller, produced more flowers and gave a higher yield than any others, although a dust containing 5 per cent. DDT, 3 per cent. γ BHC and 40 per cent. sulphur, which gave 96·7 per cent. mortality, produced the highest number of bolls. In large-scale trials of a dust of 10 per cent. DDT, 3 per cent. γ BHC and 40 per cent. sulphur in 1950, larvae in all instars were killed within a few hours of treatment, infestation by *Platyedra gossypiella* (Saund.) was reduced from 49·1 to 33·7 per cent. by one application and to 16 per cent. by two, and the yield of seed cotton per acre was about 300 lb. higher from the treated plots than from plots in which the normal hand collection of the eggs had been carried out. In the discussion that followed, the author stated that the dust was applied at about 11–13 lb. per acre on young plants and about 15–17 lb. on older ones, and that the toxic effects persisted for 2–3 weeks. One treatment should be applied against each generation.

Ankersmit (G. W.). **Local Differences in Foodplants of** *Phaedonia inclusa* **(Stål), " the Soybean Beetle " (Col., Chrysomelidae)**, pp. 800–803, 3 figs. *Phaedonia inclusa* (Stål) is a serious pest of soy bean in East and Central Java, where it was first recorded on this introduced crop in 1905, but has not been observed on it in West Java, Sumatra (with the exception of one locality on the south coast) or Malaya, although these countries are within its range. In the Experimental Gardens in Bogor, West Java, where soy bean is extensively cultivated, it occurs only on the green manure plants, *Desmodium* spp. and *Pueraria phaseoloides*. No morphological differences were found between beetles from *Desmodium* in West Java and soy bean in East Java, and they interbred freely. When beetles from *Desmodium* and from soy bean were confined with leaves of soy bean, *D. ovalifolium* and *Pueraria*, they preferred the food-plant on which they had been reared. Some larvae from *Desmodium* completed their development on soy bean; when the resulting adults were presented with the three food-plants, they fed on soy bean on the first day only and preferred *Desmodium* to *Pueraria*. Attempts in West Java to infest soy bean with beetles from *Desmodium* were unsuccessful, and soy bean adjoining a heavily infested field of *Desmodium* was not attacked, though the beetles migrated to *Pueraria* when the *Desmodium* was destroyed; there was no migration from *Pueraria* to soy bean, as occurs in East Java. In Central Java, no eggs or larvae were found on *D. triflorum* in a field in which *Phaedonia* was abundant, though there were many eggs, but no larvae, on the leguminous weed *Flemingia lineata*; the latter was not accepted in the laboratory by larvae reared on soy bean. It is concluded that *P. inclusa* was originally associated with plants such as *Desmodium* and *Pueraria*, but that a race adapted to soy bean evolved in Central Java about the year 1900 and subsequently spread to East Java, where soy beans are widely cultivated; it was introduced into southern Sumatra about 1940, probably with cattle fodder.

Weidner (H.). **Die Ausbreitung der Termite** *Reticulitermes flavipes* **(Kollar) in Hamburg** [The Distribution of the Termite, *R. flavipes*, in Hamburg], pp. 829–832. Infestation of structural timbers by *Reticulitermes flavipes* (Koll.) in Hamburg was first discovered in 1937, when injury was caused to a conduit of the municipal heating system [**26** 193]. Several further cases of damage were discovered in 1939–43 in timber in houses connected with, or not far removed from, the heating conduits, and a nest of the termite was found in 1951 in the cellar of a house that had

recently been restored. The infestation must in the latter case have arisen while the building was in ruins. The timber damaged included oak and pine.

Grandori (R.). **Protection et désinfestation du blé emmagasiné par des substances non-toxiques,** pp. 849–853. Large-scale trials showed that an Italian bentonite containing 26 per cent. silica and 65 per cent. montmorillonite controls insects in stored wheat with which it is incorporated at a rate of 0·2 per cent. and maintains it free from infestation. Adults of *Sitotroga cerealella* (Ol.), *Tinea granella* (L.), *Plodia interpunctella* (Hb.), *Oryzaephilus surinamensis* (L.), *Tenebroides mauritanicus* (L.), *Calandra oryzae* (L.), *Rhizopertha dominica* (F.) and *Laemophloeus ferrugineus* (Steph.) died within a few hours of treatment and those of *C. granaria* L. within a week. The larvae died following contact with the dust. The initial effect of the bentonite is repellent, but only insects from the superficial layers can escape and survive. In all cases, reproduction is prevented. Treating the walls with DDT to destroy insects that escape from the wheat proved satisfactory in the laboratory, and also in large-scale trials with the bentonite in farms and warehouses in Italy in 1949–51, details of which are given. The bentonite acts probably through a desiccating effect of the silica on the insects [*cf.* **38** 306, etc.]; in addition, the particles penetrate into the joints, causing abrasions and eventually preventing the movement of the mouth parts, so that the insects starve. The montmorillonite probably absorbs water and so prevents the particles from agglomerating, even at relative humidities of 90 per cent. Other advantages are the low cost of the bentonite and its harmlessness to man and domestic animals. It is most effective when used in moderately infested wheat of which the moisture content does not exceed 12·5 per cent.; when infestation is severe, the frass and débris from feeding cause the particles to agglomerate.

Busnel (M. C.) & Busnel (R. G.). **Le chauffage par rayonnement infrarouge dans la désinsectisation des chataignes,** pp. 855–860, 1 fig., 3 graphs, 9 refs. The control of *Curculio (Balaninus)* [*elephas* (Gylh.)] and *Cydia (Carpocapsa)* [*splendana* (Hb.)] in chestnuts by means of the heat induced by infra-red irradiation was investigated in France in a heat-proof chamber, 32 ins. long, 20 ins. wide and 28 ins. high, containing an upper row of 13 250-watt lamps and a lower one of 12, of which the height and distance apart could be adjusted. The chestnuts were drawn between the rows of lamps on a rack, the speed of which could be regulated, and then through a second heat-proof chamber twice the length of the first, in which the lethal temperature at the centre of the chestnuts was maintained, as a result of the increase in temperature that occurs in vegetable tissues following irradiation. For complete control, the temperature at the centre of the chestnuts had to be kept at 52–55°C. [125·6–131°F.] for 60 seconds, for which irradiation for 45–90 seconds, according to the size and freshness of the chestnuts, was required; this period could be varied by reducing the distance between the lamps or increasing their number. The advantages of this method of heating over convection methods are its rapidity, since by convection the chestnuts must be kept at 60°C. [140°F.] for 150 minutes, the smaller amount of heat required, the insects being heated more rapidly by infra-red rays than the chestnuts and reaching temperatures 2–5°C. [3·6–9°F.] higher, and the increase in the temperature of the chestnuts after irradiation, which may be as great as 3·8°C. [5·4–14·4°F.], and continues for 10–40 seconds according to size. Treated chestnuts showed very slight loss of weight, and their quality for manufacturing purposes was not impaired by treatment for up to 102 seconds. The skin of very fresh chestnuts was slightly dulled by treatment, but further tests showed that this could be avoided by introducing an air stream at the level

of the chestnuts, which lowers the temperature at the surface (normally about 160°C. [320°F.]) without affecting the internal temperature. Infra-red treatment also controls fungous pests.

Dove (W. E.). **Piperonyl Butoxide and Pyrethrins for the Protection of Grains and similar Products from Insect Damage,** pp. 875–879. An emulsion or an oil solution of 1 per cent. piperonyl butoxide and 0·1 per cent. pyrethrins applied to the walls and other surfaces of storage bins at a rate of 50 mg. piperonyl butoxide and 5 mg. pyrethrins per sq. ft. of surface about a fortnight before they are filled with wheat or other grain is the most suitable spray for killing insect pests concealed in the wood of bins in the United States. The emulsion is also used on a commercial scale for impregnating cartons and burlap, cloth or paper bags for packaged food, which is protected for at least a year, for spraying curing boards and other surfaces in storage rooms for the protection of stored cheese against cheese skippers [*Piophila casei* (L.)] and mites, and in paraffin coatings for cheeses. Tests of the acute oral toxicity of piperonyl butoxide to rats showed that the dose giving 50 per cent. mortality was 10–13 gm. per kg. body weight. Rats fed exclusively on treated food through three successive generations were unaffected by a concentration of 1,000 parts piperonyl butoxide per million parts food, but feeding and reproduction were reduced, the latter by about half, by 10,000 p.p.m. About 80 per cent. of the piperonyl butoxide passed unchanged through the intestine, and no histological changes that could be attributed to it were noticed. A dust of 0·8 per cent. piperonyl butoxide and 0·05 per cent. pyrethrins in fibrous talc is highly effective for the protection of stored grain [*cf.* **39** 16], gives good coverage, does not affect fermentation or germination and remains effective for considerably longer than the normal storage periods; examples are cited of its use in large-scale tests in the United States in 1949–50 for the protection of grain, chiefly wheat and maize. No piperonyl butoxide was found in flour milled from treated wheat and tested by a method capable of detecting as little as 1 p.p.m. The use of this dust is recommended as a preventive measure and for the control of moderate infestations; it should be applied soon after harvest.

Bennett (S. H.) & Thomas (W. D. E.). **Experiments on the Absorption and Fate of a Systemic Insecticide Bis(bisdimethylaminophosphonous) Anhydride $[(CH_3)_2N]_2PO\text{-}O\text{-}PO[(CH_3)_2N]_2$ in Plants,** pp. 981–985, 5 refs. The absorption of schradan (bis(bisdimethylaminophosphonous) anhydride) by plants was investigated by applying aqueous solutions of 0·6–0·025 per cent. schradan containing P^{32} to individual leaves on plants in pots by dipping or spraying at the rate of 1–2 ml. per plant; radioactivity was less than 2·5 microcuries per ml. There was a significant difference between the amounts absorbed by apple stocks treated with 0·5 and 0·05 per cent. solutions, and plants treated in the morning absorbed significantly more than those treated in the evening. When broad bean, runner bean and *Coleus* were subjected to different combinations of light and darkness before and after treatment with 0·5 per cent. schradan, there were differences between the species in the amounts absorbed under comparable conditions and in the amounts absorbed by a given species under different conditions. Absorption was greatest when light followed treatment. Preliminary tests in which 0·4 per cent. schradan was applied to leaves of chrysanthemums indicated that the lower surfaces absorb more than the upper. In tests on translocation in which leaves in various positions on the stems of apple stocks were treated, less than 0·5 per cent. of the schradan absorbed had been translocated from treated leaves after eight hours, about 5 per cent. after 72 hours, and about 10 per cent. after 144 hours, except from

the upper leaves, which lost less than 5 per cent. Translocation was chiefly to leaves above those treated, though a fair proportion was translocated to the lower parts of the stem and the roots. In chrysanthemum, only 8 per cent. of the absorbed schradan was translocated in 384 hours. Little translocation occurred in plants that were sprayed when the carbohydrate content was low and were subsequently kept in the dark, a limited amount in plants similarly treated in which the carbohydrate content was fairly high, and most when the plant processes were active. The rate at which schradan was broken down in the plant varied with species, and it is thought that the loss of insecticidal activity that was observed after a week was possibly due in broad bean and runner bean to a breaking down of the compound and in *Coleus* and chrysanthemum largely to dilution to a sub-lethal concentration as a result of growth. In preliminary experiments, the lethal concentration for *Aphis fabae* Scop. was about 10 mg. per kg. plant weight.

de Mol van Otd Loosdrecht (W. E.). **Control of Grubs of the Daffodil Fly in Bulbs by Carbonic Acid and Oxygen under Pressure,** pp. 995–998. An account is given of experiments in Holland in 1938–43 in which it was shown that treatment of daffodil bulbs in autumn with mixtures of carbon dioxide and oxygen (1 : 4 or 3 : 7) under pressure controls larvae of *Merodon (Lampetia) equestris* (F.) in them without damage to the bulbs. Various exposure periods and pressures were tested in the different years, and it appears that exposures of the order of 6–8 hours at 12–14 atmospheres are fully satisfactory.

Vekemans (J.). **Quelques applications du parathion aux cultures européennes au Katanga,** pp. 1052–1058, 7 refs. The following is largely based on the author's summary of this account of tests with parathion in the Belgian Congo. A spray of 0·03 per cent. wettable parathion at 0·27 lb. toxicant per acre reduced the percentage of tobacco leaves infested by *Myzus persicae* (Sulz.) from about 90 to 0 and was superior to sprays of DDT, nicotine or nicotine sulphate. When properly applied, sprays were superior to dusts, but the latter are more suitable for use under local conditions, and dilutions of parathion in a locally produced tobacco powder appeared promising. Potato tubers dusted in the warehouse with 0·3 per cent. parathion in tobacco powder or immersed in a suspension of 0·15 per cent. parathion were protected from attack by mealybugs, and Lecaniine Coccids on *Citrus* were eliminated by three applications of an emulsion of 1 per cent. mineral oil containing 0·06 per cent. parathion.

Albrecht (F. O.). **The Breeding of the Red Locust in Captivity.**—*Bull. ent. Res.* **44** pt. 1 pp. 1–4, 5 refs. London, 1953.

Considerable difficulty has been experienced in keeping adults of *Nomadacris septemfasciata* (Serv.) alive in cages for any length of time, and observations in 1950 on 2,000 collected in the Rukwa Valley, Tanganyika, and kept in wire gauze cages, where they all died within ten days, indicated that they are unable to replace water lost by evaporation. When locusts were kept in glass cages of which the insides were sprayed with water several times a day, mortality during the dry season of 1951 was less than 2 per cent. Only one generation develops each year in the outbreak areas, the adult diapause lasting for about eight months. This diapause is evidently dependent on climatic conditions, since three successive generations were successfully reared in 15 months in cages [*cf. R.A.E.*, A **24** 229]. Eggs collected in the Rukwa Valley were taken to Abercorn, where they hatched between mid-December 1950 and early

January 1951. The hoppers were placed in glass cages of 20 cu. ft. capacity and gave rise to adults in late March. These began to oviposit in early July, though most oviposited in August. The second generation was reared in the central Rukwa, where temperatures were higher and less variable, and was started in late September 1951. The first adults appeared in mid-November, and oviposition began a month later and continued until 11th January 1952. Eggs laid in January gave rise to adults from mid-April. In the cages, the relative humidities during the first and second generations ranged from 70 to 100 per cent. and, during the second generation, the maximum day temperatures were 40–58°C. [104–136·4°F.] and the minimum night temperatures 16–24°C. [60·8–75·2°F.]. The egg stage lasted an average of 25 days, though hatching occurred from one of 92 overheated egg-pods in 17 days. The minimum durations for the hopper stage and the pre-oviposition period were 48 and 30 days, respectively. The average number of egg-pods deposited per female was about 2·2.

Suggestions are made for rearing *N. septemfasciata* in the laboratory. The failure of earlier attempts to rear it in the field is attributed to insufficient humidity, and of attempts in the laboratory at adequate humidities, to low temperatures. The females readily oviposit in glass tubes containing sand if the latter are placed against the glass wall of the cage nearest to the source of light.

Crooke (M.). **Some Notes on** *Anoplonyx destructor* **Benson.**—*Bull. ent. Res.* **44** pt. 1 pp. 77–81, 1 pl., 1 fig., 3 refs. London, 1953.

The author describes the eggs and larvae of *Anoplonyx destructor* Benson and gives the results of observations over several years on its bionomics on larch in Britain [*cf. R.A.E.*, A **40** 369]. The females of this sawfly are present from mid-April until early June. The eggs are laid singly in the needles of the short shoots, and the cutting of the oviposition slit causes part of the needle to die. The larvae hatch in 14–15 days and feed on the foliage. They become fully grown in the laboratory in 43 days at a mean temperature of 60°F., though larvae are usually still feeding in the field in late September or early October. When fully fed, they enter the upper layers of the soil litter and spin cocoons in which they pupate in the following spring or the one after.

A. destructor is widely distributed in southern and east-central Scotland, in northern and western England, and throughout Wales. *Larix decidua*, *L. kaempferi* (*leptolepis*), and the hybrid larch, *L. eurolepis*, are commonly grown as forest crops in Britain, and all are subject to attack; *L. occidentalis* is also a food-plant. Infestation has occurred on trees varying in age from 4 to 67 years but is usually heaviest on trees about 20 years old; trees by rides and at the edges of plantations are the most susceptible. Damage to the foliage first becomes noticeable on the lower branches, where oviposition is heaviest, and progresses upwards through the crown during the summer. Injury is limited because the larvae consume only part of each needle on which they feed, resulting in a scorched appearance of the foliage, and because most of the damage is due to larvae in the fourth and fifth instars and therefore occurs late in the growing season. From population estimates made while the larvae were in the lower part of the crown, by jarring a sample branch over a sheet 2 ft. 10 ins. × 1 ft. 10 ins. in area (referred to as a "standard beat"), it was found that trees from which fewer than 30 larvae were obtained per beat showed no obvious damage, while counts of 30–80 larvae per beat were associated with obvious but not severe damage and over 80 with severe "scorching." Although attack appears to have no serious effect on the trees, it undoubtedly reduces the

rate of growth, especially when associated with infestation by other pests. *Dahlbominus fuscipennis* (Zett.), stocks of which were introduced from Canada, was found to parasitise *A. destructor* in the laboratory, and some 10,000 examples of this Eulophid were released in infested plantations in Perthshire in 1950, either as adults or in cocoons of *Neodiprion sertifer* (Geoffr.); infestation was quite heavy during 1951 and 1952, however.

Duffy (E. A. J.). **Lead Cable severely damaged by *Ptinus tectus* Boieldieu (Coleoptera, Ptinidae).**—*Bull. ent. Res.* **44** pt. 1 pp. 83–84, 1 fig., 2 refs. London, 1953.

The following is virtually the author's summary. An account is given of damage in Kent to the lead sheath of a cable and to its wooden drum by larvae of *Ptinus tectus* Boield. The original infestation resulted from the accumulation in the hollow drum-hub of food discarded by workmen. The mature larvae, in order to pupate, bored into the hub of the drum and the lead sheath of the cable, which was 0·06 in. in thickness, thus producing innumerable excavations and some perforations in the sheath of several hundred feet of cable.

Hall (D. W.) & Howe (R. W.). **A revised Key to the Larvae of the Ptinidae associated with Stored Products.**—*Bull. ent. Res.* **44** pt. 1 pp. 85–96, 92 figs., 1 fldg. table, 4 refs. London, 1953.

Manton's key to the mature or nearly mature larvae of Ptinids that infest stored products in Britain, as modified by Hinton [*R.A.E.*, A **40** 68], is here extended to include two other species, and Hinton's couplet is modified. Some of the characters are shown in a comparative table, by means of which the larvae of each of the 15 species dealt with can be determined quickly, though probably less accurately than by means of the key, and these characters are also figured for most or all of the species.

Bond (J. A. B.). **Trunk Absorption of a systemic Chemical by Coffee.**—*Bull. ent. Res.* **44** pt. 1 pp. 97–99, 1 pl., 3 refs. London, 1953.

During investigations in 1951 on the control of *Planococcus kenyae* (Le Pelley) on coffee in Kenya, a proprietary preparation (Hanane), stated to consist mainly of bis(dimethylamino)fluorophosphine oxide, applied to the soil in a groove round the base of the tree gave inconsistent results, and the effect of applying it to the trunk was accordingly tested in 1952. This was done by removing loose bark from a section of trunk about 4 ins. wide and a few inches above the level of the soil, placing a band of oiled silk, 6 ins. wide, round the trunk with its top edge tied tightly round the lower edge of the scraped area, covering the scraped area with a double thickness of surgical lint soaked in the diluted insecticide, and pulling the oiled silk over it so that any liquid not immediately absorbed by the lint would collect in the fold. When a tree was treated in this way with 32·5 gm. active ingredient in 250 cc., the leaves began to show injury after five days and the tree was almost defoliated after 14, though in earlier tests in which the chemical was applied to the soil at the same or higher rates it caused little or no damage. Two infested trees of which the trunks were treated with 2 or 5 gm. active ingredient, respectively, in 200 cc. were not injured and the infestation was reduced after two weeks and completely controlled after 12, though untreated trees were still infested; in further tests, dosages of up to 10 gm. active ingredient in 200 cc. gave good control and caused little damage to the trees, though there was some yellowing of the foliage on

most. At 8 gm. in 200 cc., complete control was given in two weeks whether the bark was first removed to expose the cambium or only lightly scraped, but in the first case the tree became almost completely defoliated after three weeks, whereas in the second there were no phytotoxic effects. When dosages of 3 or 6 gm. in 200 cc. were applied to the trunks after slight abrasion or to the soil in a shallow groove round the base, a metal cone being used to prevent rapid lateral dispersal, there was no injury to the trees but the lower dosage caused no significant changes in mealybug populations. The higher dosage caused a gradual decrease in population and gave almost complete control in eight weeks when applied to the trunks; it was ineffective when applied to the soil, but a second application after three weeks gave fair control. Application to the trunk without the waterproof and absorbent bands was unsatisfactory, doubtless owing to the volatility of the chemical, and absorption and translocation were best when the area of the trunk to be treated was first well scraped to expose the cambium in several places.

Williams (G.). **Field Observations on the Cacao Mirids, *Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.), in the Gold Coast. Part I. Mirid Damage.**—*Bull. ent. Res.* **44** pt. 1 pp. 101–119, 1 fig., 15 refs. London, 1953.

The following is mainly the author's summary. *Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.) are important pests of cacao in the Gold Coast. The damage sustained by the cacao is due, in part, to the direct effects of feeding by these Mirids, but more to the subsequent invasion of the resulting lesions by the weakly pathogenic fungus, *Calonectria rigidiuscula*. In the field, Mirid damage may be classified into three categories. "Blast" is the result of light diffuse attack and is so named because of its similarity to fire damage. "Stagheaded cacao" is more severe, the trees showing numerous small crown branches but forming a poor canopy. "Mirid pocket" describes severe damage, normally limited to a small area, the trees losing the crown completely and the pole-like trunks bearing numerous lateral chupons. In general, stagheaded symptoms are more prevalent where cacao is grown without shade, and pockets where shade trees are used.

Consideration of the factors associated with Mirid damage shows that it is correlated with breaks in the cacao canopy. Evidence is brought forward to suggest that such breaks normally precede, rather than result from, Mirid attack. The canopy itself is unsuitable for the development of either species, the major part of the population being confined to the sub-canopy levels. The initial causes of the breaks are, most frequently, the die-backs associated with swollen-shoot disease or with adverse water relations. The falling of shade trees causes a number of breaks, and, where cacao is grown without shade, the Mirids themselves may be a cause.

The most important single factor influencing the form of the cacao canopy, and thus the course of Mirid attack, is the amount of overhead shade, particularly that provided by trees little taller than the cacao itself. Shade that is too dense causes etiolation of the cacao and thus renders it susceptible to attack, the resulting damage generally taking the form of a pocket. Shade that is too sparse does not shield the cacao from the adverse effect of exposure. The Mirid damage in such areas generally assumes the stagheaded form.

It is suggested, from field experiments, that the invasion by Mirids of areas suitable for colonisation is not by random movements, but is determined by the change in some physical factor resulting from the broken

canopy. Changes in light intensity are the most obvious results of such breaks [*cf. R.A.E.*, A **40** 365], but further experiments are needed to determine which is the operating factor. Degraded cacao is prevented from recovery, not by Mirid attack alone, but by the interaction of it with the presence of *C. rigidiuscula*, and by increased exposure.

The sampling methods employed are described, and in a discussion of the bearing of the results on control, it is stated that the use of insecticides on old trees appears feasible, since the Mirids breed on the developing green pods and the chupons below the canopy, and applications of a persistent insecticide to these should be effective. Cultural methods comprise the establishment of a complete canopy by the time the tree is too large to be painted with DDT [*cf.* **39** 374] and its subsequent maintenance, and the provision of suitable shade. Old shade trees cannot be removed without some damage to the cacao; if this occurs in March–April, the cacao is likely to recover, but if it occurs during November–January, it is likely to be followed by Mirid attack. Planting sites in which the soil is waterlogged or subject to violent fluctuations in the water level should be avoided.

Mukerjea (T. D.). **The Relationship between the Stage of Development and Susceptibility to DDT and the Pyrethrins of *Diataraxia oleracea* (L.), *Tenebrio molitor* L., and *Periplaneta americana* (L.).**—*Bull. ent. Res.* **44** pt. 1 pp. 121–161, 2 pls., 46 graphs, 46 refs. London, 1953.

An account is given of experiments on the comparative resistance of eggs, larvae and pupae of *Diataraxia oleracea* (L.), larvae, pupae and adults of *Tenebrio molitor* L., and nymphs and adults of *Periplaneta americana* (L.) to sprays of p,p'DDT or pyrethrins. A constant volume of spray was applied to the insects in petri dishes in an apparatus described [*R.A.E.*, A **40** 185], and the insects were subsequently kept in the dishes and given food if necessary. The results are shown in numerous tables and discussed. On the basis of concentration required for 50 per cent. mortality, there were great differences within the stages of a given species, particularly between the instars. The differences were much reduced when resistance was expressed as weight of insecticide per unit weight of insect required to give 50 per cent. mortality. It is concluded that inferences based on comparison of insecticides applied against one stage or instar of a given species will not necessarily hold for any other stage of development of that or any other species.

It was observed that DDT at the highest concentration used against the eggs (0·075 per cent. w/v) failed to prevent the development of the embryos of *D. oleracea*, death occurring only when the fully developed embryo began to gnaw its way out of the shell. Pyrethrins on the other hand prevented embryonic development if applied at sufficiently high concentrations. With both insecticides, resistance of eggs decreased with age, but that of larvae of *D. oleracea* and *T. molitor* and of nymphs of *P. americana* increased, the resistance being markedly higher in the later instars. Neither DDT nor pyrethrins prevented development of pupae at the highest concentrations used (0·5 and 2·5 per cent. w/v, respectively), but both prevented normal emergence of *T. molitor* and pyrethrins that of *D. oleracea*. In each case, pupae of middle age were more resistant than younger or older ones. Adults of *T. molitor* aged 4 weeks were much more resistant to both insecticides than those aged 1 or 8 weeks, but adults of *P. americana* were more resistant when 1–4 weeks than when 12–24 weeks old.

Roberti (D.). **Le oplocampe del susino. II.** *Hoplocampa rutilicornis* **Klug.** [*Hoplocampa* spp. on Plum. II. *H. rutilicornis.*]—*Boll. Lab. Ent. agr. Portici* **9** (1949) pp. 8–26, 5 figs., 7 refs. Portici, 1950.

Hoplocampa flava (L.) and *H. minuta* (Christ) have long been known as pests of plum in Italy, but the author reports in this second part of a series [*cf. R.A.E.*, A **38** 43] that the most injurious species of the genus on that tree in Campania, to the north of Naples, is *H. rutilicornis* (Klug), which is commoner there than either of the other two and has probably been confused with *H. minuta*. All stages of *H. rutilicornis* are described, and an account is given of studies on its bionomics and control in 1947–48.

The adults emerged between early March and early April, and the females oviposited on any variety of plum in flower. The eggs were laid in the sepals, usually one to each flower, and the larvae hatched in about 12 days and fed in the young fruits for about 20 days, passing from one to another and each attacking 3–4 fruits, which subsequently fell to the ground. When fully fed, the larvae entered the soil and constructed cocoons in which they overwintered. Pupation occurred in the following February. The percentages of fruits infested varied with the place and year, and ranged from 10–20 to 100.

Three series of tests on control were made in different localities in 1948. Sprays were applied on 25th or 26th March, when hatching had just begun and three-quarters of the petals had fallen, and the results were estimated 18–19 days later. In the first, the infestation percentages were reduced from 52–71·2 for no treatment to 0–3·5 by an emulsified solution of 0·2 per cent. DDT prepared from an emulsion concentrate (Gesarol 9255 [*cf.* **41** 130]), 2·7–7·7 by 0·1 per cent. DDT from a Gesarol wettable powder, 2·9–6·3 by 0·5 per cent. DDT from another wettable powder and 9·5–14·9 by 1 per cent. wettable Tiogamma (containing 20 per cent. BHC). In the second experiment, they were reduced from 91·8–97·9 to 0–0·6 by the DDT emulsified solution, 4·4–6·2 by the Gesarol powder, 7·3–8·8 by the other wettable DDT and 5·3–15 by Tiogamma. In the third, they were reduced from 24·7–41·3 to 0 by the emulsified solution, 3·3 by the Gesarol powder, 2·6–4·7 by the other wettable DDT and 8·2–9·8 by Tiogamma, and in a more heavily infested area, Tiogamma reduced the percentage infestation from 95·2 to 8·5–22·1. Sprays of lead arsenate and nicotine were applied in some tests but gave poor results.

Lupo (V.). **Studio biologico sull'** *Anomala ausonia* **var.** *neapolitana* **Reitt.** [A biological Study of *A. ausonia* var. *neapolitana.*]—*Boll. Lab. Ent. agr. Portici* **9** (1949) pp. 78–110, 7 figs., 47 refs. Portici, 1950.

Investigations on the bionomics and control of *Anomala ausonia* var. *neapolitana* Rttr. [*cf. R.A.E.*, A **37** 458] near Naples in 1941–49 showed that the adults emerge at the end of May and live for about 40 days, feeding for 8–12 days before pairing. They attack the leaves of many trees and plants and cause serious injury to grape vines, on which the tendrils and young fruits are also damaged. About two days after pairing, the females enter the soil and oviposit, laying up to about 100 eggs each in 2–8 days. The larvae hatch in an average of 15 days and feed on decaying organic matter in the soil. At the approach of winter, when the temperature falls below 10°C. [50°F.], they move to greater depths and cease activity. Feeding is resumed in the second half of March, and pupation occurs at the end of May, the prepupal and pupal stages lasting 2 and 8 days, respectively.

Larvae of *Hister major* L., *Alobates* sp. and *Asilus* sp. were predacious on the larvae, and various ants on the eggs and young larvae. In tests, sprays of 1·5 per cent. lead arsenate or 2 per cent. aluminium arsenate proved effective against the adults, and one of 2 per cent. BHC (as Tiogamma) with an adhesive also gave good results, but lost its toxicity after about ten days.

Jannone (G.). **Studi e ricerche di entomologia agraria in Eritrea e in Etiopia. V. Rinvenimento, morfo-biologia e danni della *Zophopetes dysmephila* Trimen (Lep., Rhop., Hesperiidae) in Eritrea.** [Studies and Researches on agricultural Entomology in Abyssinia and Eritrea. V. The Discovery and Morpho-biology of *Z. dysmephila* and the Damage it causes in Eritrea.]—*Riv. Agric. subtrop.* **42** no. 10–12 pp. 230–250, 11 figs., 3 refs. Florence, 1948. (With a Summary in English.) **VI. Rassegna dei casi entomologici più notevoli riscontrati in Eritrea durante il 1945.** [Reports on the most notable Insects found in Eritrea in 1945.]—*Ann. Fac. Agr. Pisa* (N.S.) **9** pp. 279–312, 7 figs. Pisa, 1948. (With Summaries in French, English and German.) **VII. Reperti biologici e morfologici nuovi o poco noti su di un importante parassita delle cavallette: *Stomatorrhina (Idia) lunata* Fab. (Diptera, Calliphoridae).** [New or little-known biological and morphological Data on *S. lunata*, an important Parasite of Locusts.]—*Boll. Lab. Ent. agr. Portici* **9** (1949) pp. 140–186, 10 figs., refs. Portici, 1950.

In the first of these three parts of a series [*cf. R.A.E.*, A **39** 67], descriptions are given of all stages and of observations on the bionomics of *Zophopetes dysmephila* (Trimen), a Hesperiid that was found in the highlands of Eritrea in 1939 attacking the ornamental palm, *Phoenix canariensis*. This proved to be its usual food-plant, but slight infestation of *Chamaerops humilis* and date palm was also observed. The adults were active at dusk and were most numerous in February–March, May–June and October–November. The eggs were laid on the leaves, singly or in groups, each female laying some 100–150 or more. The larvae hatched in 20–30 days and fed on the leaf segments, the edges of which were webbed together to form a shelter. The larval stage lasted 30–55 days, the prepupal stage 3–8 days, and the pupal stage, which is passed in the webbed leaves, 18–25 days.

In the second part, a list is given of 79 insects, a mite and a nematode found in Eritrea in 1945. The insects were either injurious to plants or parasitic on those that were, and pests believed to be recorded from the country for the first time include *Macrosiphum solidaginis* (F.) on safflower (*Carthamus tinctorius*), *Argyroploce leucotreta* Meyr. on *Citrus*, *A. wahlbergiana* (Zell.) on castor [*Ricinus communis*], *Lagria villosa* F. on potato and *Julodis caillaudi* (Latr.) on sorghum. Notes are given on local distribution and in some cases on bionomics and control.

In the third part, observations are recorded on *Stomatorrhina lunata* (F.) in Eritrea. Larvae of this Calliphorid are known to feed on the eggs of locusts, particularly those of *Schistocerca gregaria* (Forsk.), and the normal mode of oviposition in the oötheca is described [*cf.* **38** 43]. In July 1946, however, mature larvae of the Calliphorid emerged from several adult females of *S. gregaria* that had been injured or killed by flame-throwers during control operations and taken to the laboratory, and subsequent dissection of other females resulted in the finding of 13 further larvae. The larvae occurred in the body cavity of females that were sexually mature and contained numerous eggs, and 3–6 were found per infested locust. In some of the hosts, all the eggs had been destroyed and the body tissues attacked. Some of the hosts in which larvae were found showed no external injury at

all, while others were damaged. The larvae were transferred to sand, and all gave rise to normal adults about 23 days after the presumed date of oviposition, as compared with 18 days for individuals taken from egg-pods. Two puparia were also found in apparently normal females of *Schistocerca* collected from trees. The probable ways in which attack on adult locusts might occur and its advantages for the species are discussed.

The adult males and females of *Stomatorrhina lunata*, which are described, are usually present in equal numbers. In the laboratory, adults survived for 4–6 days without food and for up to 34 days when sugar solution and flower heads were provided. No pairing occurred, however, even when the flies were exposed to the sun, and all individuals died after exposure to the sun's rays for three hours at an air temperature of about 30°C. [86°F.]. The distribution of the parasite in Eritrea is uneven. Attack on the egg-pods of *Schistocerca* sometimes reaches 100 per cent., is most intense at or above about 4,500–5,000 ft., and is proportionately less at lower altitudes. The species is considered to be migratory, following the swarms of its host, but its effectiveness varies with the climatic suitability of the area for development. There would be no advantage in rearing it in the laboratory for field release. The suitability of various soils and the egg-pods of various locusts for oviposition are discussed.

Di Martino (E.). **Ancora una prova di lotta contro la mosca delle frutta.** [A further Experiment on the Control of the Fruit-fly.]—*Ann. Sper. agr.* (N.S.) **6** no. 1 pp. 5–14, 5 refs. Rome, 1952.

Pennisi (L.). **Indagine analitica sulla penetrazione del DDT nelle arance.** [Analytical Investigations on the Penetration of DDT into Oranges.]—*T.c.* pp. 15–22, 9 refs. (With Summaries in English.)

In the first paper, an account is given of observations in the autumn of 1950 on the bionomics and control of *Ceratitis capitata* (Wied.) in Sicily, where infestation was particularly heavy following a very warm summer, and plum, which is not among the host-fruits recorded from that area by Costantino [*cf. R.A.E.*, A **39** 72, etc.], was attacked as well as many other fruits. Numerous oviposition punctures were found on lemons, usually when these were adjacent to other infested fruits, particularly peach, and also on other *Citrus* fruits. Although the larvae do not always develop in *Citrus*, the attack causes the fruits to ripen prematurely and fall. Larvae were present in about 1 per cent. of the fallen oranges collected on 6th–8th December, and adults were reared from 21 per cent. of the fallen oranges showing punctures.

In an experiment on control, orange trees were sprayed with 0·25 and 0·5 per cent. Gesarol 50 (found on analysis to contain 49 per cent. DDT), with a wetter, on 27th September, when the percentages of fruits showing punctures in the two experimental blocks and the controls were 5, 15 and 15, respectively, again on 17th October, when they were 23·4, 3·4 and 20, and a third time on 7th November, when they were 3·4, 13·4 and 60. At a final count on 6th–8th December, the percentages punctured were 7·39 and 5·24 for 0·25 and 0·5 per cent. Gesarol 50, respectively, and 57·89 on the controls, and the numbers of punctures per fruit were considerably lower on the treated than on the untreated trees. Counts of the adults taken in bait-pans containing 5 per cent. diammonium phosphate, which were placed in equal numbers of treated and untreated trees on 28th September, showed that the flies taken on the treated trees represented about 32·1 per cent. of the total on 14th October, 11 per cent. on 7th November and 29·4 on 15th November.

In the second paper, the author describes investigations on the penetration of the DDT into the treated oranges. The following is based on his summary of the results. No DDT was found in the pulp. The DDT residues on the fruit surface averaged 1·15–2·5 and 4·67 parts per million, and the amounts in the albedo 1·22–1·77 and 3·2–3·3 p.p.m. for 0·25 and 0·5 per cent. Gesarol 50, respectively.

Manzoni (G.) & Carli (E.). **Indagini sulla lotta contro la cocciniglia cotonosa della vite. I. Prove di lotta invernale ed estiva contro la cocciniglia cotonosa della vite.** [Investigations on the Control of the Grape-vine Mealybug. I. Experiments on Winter and Summer Treatments against the Mealybug.]—*Ann. Sper. agr.* (N.S.) **6** no. 1 pp. 171–192, 4 figs., 3 graphs, 12 refs. Rome, 1952.

Pieri (G.). **II. Relazione sui trattamenti insetticidi polverulenti contro la cocciniglia cotonosa della vite, effettuati nel 1950.** [II. An Account of Treatments with insecticidal Dusts against the Mealybug made in 1950.]—*T.c.* pp. 193–196, 3 refs.

Pieri (G.) & De Rosa (T.). **III. Studio dell'eventuale azione degli esteri fosforici sulla fermentazione alcoolica.** [Studies on the possible Effect of phosphoric Esters on alcoholic Fermentation.]—*T.c.* pp. 197–206, 3 graphs, 5 refs. (With Summaries in English.)

In the first part, the authors briefly describe all stages of *Planococcus* (*Pseudococcus*) *citri* (Risso), which has caused increasing damage to grape vines in Italy in recent years, and review its bionomics from the literature. It has 3–4 generations a year near Venice, and the winter is passed in the egg, nymphal and adult female stages. The damage caused by the feeding of the mealybugs is not great, but growth is greatly impeded and the vines sometimes killed by the heavy accumulations of a sooty mould (*Capnodium salicinum*) that develops on the honeydew from the insects and the sugary sap that oozes from the feeding punctures [*cf. R.A.E.*, A **26** 757]. Reasons for the recent increase in numbers, which are discussed, include low rainfall in autumn and a series of unusually mild winters.

In experiments on control in 1950, proprietary preparations of parathion and oil emulsions were applied alone or in combination in dormant and summer sprays. The dormant sprays were applied between 28th March and 2nd April to vines, some of which had been scraped free of loose bark, and the summer ones in August to vines that had been scraped and given a winter spray of lime-sulphur. The results, which are not given in detail, showed that the effectiveness of the dormant treatments varied directly with the care with which the vines had been scraped. Sprays of 0·015–0·02 per cent. actual parathion or 4–5 per cent. winter oil were effective, and slightly superior control was given when the parathion was combined with oil at half the concentration. Summer treatment with parathion proved effective at the same concentration, but this should be increased to 0·03 per cent. in cases of severe infestation. Summer oils destroyed the bloom on the grapes. Summer treatments with parathion are preferred; they should be applied when the second or third generation appears, at the beginning of July and mid-August, respectively.

In a subsidiary test on the juice from grapes bearing light deposits of sooty mould and that from sound grapes, the sugar content of the former was slightly reduced, fermentation was more rapid and violent, and the subsequent alcohol content somewhat lower.

In the second part, it is reported that inconclusive results were given by dusts of 0·02 or 0·05 per cent. parathion in talc or bentonite applied against

P. citri in the field in August 1950. In laboratory tests in which infested leaves were dusted, the mortality percentages after three days were 72·4 and 80·3 for 0·5 and 1 per cent. parathion in sulphur, respectively, 48·2, 37·5 and 74 for 0·2, 0·5 and 1 per cent. parathion in bentonite, 12·3 for sulphur alone, and 0 in the controls.

The third part contains an account of investigations showing that treatment with 0·015 per cent. parathion in an emulsion spray had no effect on fermentation when applied 70 days before picking, accelerated it when applied 40 days before, and delayed it when applied only a short time before, while in no case was the flavour of the wine affected.

Di Martino (E.). **Anomalie di sviluppo su piante di *Citrus* determinate da un Eriofide.** [Abnormalities of Development in *Citrus* Plants caused by an Eriophyid.]—*Ann. Sper. agr.* (N.S.) **6** no. 1 pp. 241–248, 3 pls., 4 figs., 4 refs. Rome, 1952. (With a Summary in English.)

Deformation of the leaves, fruits and flowers of *Citrus*, particularly lemon, in Sicily has been found to be caused by an unidentified Eriophyid that feeds on the buds. The injury resembles that caused by *Aceria* (*Eriophyes*) *sheldoni* (Ewing) in California [*R.A.E.*, A **30** 429, etc.], and is widespread in Sicily, where 60–80 per cent. of the flowers in one lemon grove were reported to be infested in spring and deformed fruits were developing. Damage is most noticeable on young trees, and older ones do not appear to be so seriously affected, although the mite is present on them.

[Vasić (K.).] Васић (К.). **The Results of an Examination of the Pupae of *Lymantria dispar* L. in the Year 1948.** [*In Serbian.*]—*Plant Prot.* no. 2 pp. 25–34, 1 graph. Belgrade, 1950. (With a Summary in French.)

Lymantria dispar (L.) is a major pest of forests and orchards in Yugoslavia and caused severe damage throughout the country in 1946–48. In order to investigate the effectiveness of its parasites, nearly 63,000 pupae were collected in various districts and examined in June 1948. In all, about 32 per cent. of the males and 46 per cent. of the females were parasitised. Most of the parasites were Diptera, and by far the most numerous of these was *Sarcophaga carnaria* (L.). The Diptera were themselves parasitised to the extent of 60 per cent. by Chalcidoids. In addition, a few Ichneumonids and Braconids were observed, notably *Apanteles liparidis* (Bch.) and *A. solitarius* (Ratz.), which were very active in some localities. The density of the parasites varied directly with that of the host, and it is concluded from the observations that their importance increases as an outbreak progresses, until they finally become so numerous as to be the main factor in bringing it to an end.

Blanka (A.). **Utvrdivanje najefikasnijih mjera za suzbijanje klisnjaka (Elateridae).** [Determination of the most efficacious Measures for the Control of Elaterids.]—*Plant Prot.* no. 2 pp. 35–48, 9 refs. Belgrade, 1950. (With a Summary in French.)

Numerous tests were carried out in Yugoslavia in 1948–49 on the effectiveness of proprietary preparations of DDT and BHC in protecting various crops against wireworms. Vegetables were treated by applying dusts of 5 per cent. DDT or 5 or 10 per cent. BHC to the holes in which the seedlings were to be planted, dipping the roots of the seedlings in mixtures

of these dusts with soil and water prior to planting, or watering the soil round the seedlings with an emulsified solution of DDT, and field maize by applying the 10 per cent. BHC dust to the soil at rates of 36–108 lb. per acre and harrowing it in before sowing. The results, which are given in numerous tables, showed that BHC afforded a high degree of protection, improved the appearance of the plants and stimulated growth. DDT did not give much protection. In laboratory tests, treatment with BHC did not injure lettuce, crucifers, cucumber or onion, but was harmful to tomato, *Capsicum* and potato. Dusts of 5 per cent. DDT or BHC applied to the seeds at the rate of 1–2 gm. per 100 seeds did not reduce the germination of peas, maize or wheat.

Panjan (M.). **Ispitivanje stolbur-a Solanacea i način suzbijanja.** [Investigations on Stolbur of Solanaceae and its Control.]—*Plant Prot.* no. 2 pp. 49–58, 5 figs., 17 refs. Belgrade, 1950. (With a Summary in French.)

In Yugoslavia, the virus disease of solanaceous plants known as stolbur [*cf. R.A.E.*, A **39** 61] was first observed in a severe form on tomato near Zagreb in 1946, and subsequent investigations showed that it was widely distributed throughout the country, and caused much damage, especially in dry years. Information on the disease is reviewed from the literature, and it is pointed out that the Cixiid, *Hyalesthes obsoletus* Sign., which is the vector in South Russia, occurs in Yugoslavia. On infected tomato, the flower buds become thickened and often do not develop and the fruits are woody and tasteless. Other solanaceous plants found naturally infected were potato, near Zagreb, and tobacco, in Dalmatia and Herzegovina.

In experiments in 1948 and 1949 on the control of the disease by treatments applied against the vector, tomato plants were dusted 2–3 times, beginning in mid-June, with proprietary preparations of DDT and BHC. The percentages of infected plants in the treated plots were greatly reduced in both years as compared with the controls, but both preparations, and particularly that containing BHC, caused scorching. No variety of tomato resistant to the disease was found, and of various species of *Solanum* tested with a view to producing a resistant tomato hybrid, *S. ochroleucum* and *S. douglassi* proved resistant and *S. racemigerum* susceptible.

Tominić (A.). **Opažanja iz biologije i suzbijanja maslininovog tripsa (*Liothrips oleae* Costa).** [Observations on the Biology and Control of the Olive Thrips, *L. oleae*.]—*Plant Prot.* no. 2 pp. 73–85, 8 refs. Belgrade, 1950. (With a Summary in English.)

Great losses of olives are caused in Yugoslavia by *Liothrips oleae* (Costa), which is particularly abundant along the central and southern coast of Dalmatia and on the adjacent islands. All stages of this thrips are described, and an account is given of observations in 1941–48 on its bionomics, which resembled those recorded from Italy [*cf. R.A.E.*, A **22** 463; **23** 51]. Leaves, flowers and fruits were attacked, and there were three generations a year. Winter was passed mainly in the adult stage, and the hibernating population probably included some adults of the first two generations, since individuals that emerged at the beginning of July survived to the end of the following February, when observations on them were discontinued. Winter was passed in crevices on the trees, chiefly in the galleries of Scolytids. Activity could be resumed at any time under

favourable conditions, and females kept on an olive twig at 25°C. [77°F.] laid eggs, of which many gave rise to adults. In spring, oviposition began in late March or early April, when the temperature reached about 15°C. [59°F.], and the eggs were laid chiefly in the galleries of Scolytids, though some were observed beneath scales of parasitised Coccids and in other situations on the trunks of the trees. In the laboratory, oviposition continued until the second half of July, and the maximum number of eggs laid by any one female was about 150. Eggs laid in the first half of April hatched in 20 days, and those laid at the end of May in about 12 days. Development to the adult stage was completed in about 7 weeks, and the first adults emerged in mid-May. The second generation developed in about half this time, adults emerging early in the second half of June. Some eggs were laid by them before the onset of hot dry weather in July, but activity was then suspended until the end of August or the beginning of September, when heavy rains occurred and young leaves appeared on the trees. The thrips passed the intervening period sheltering under leaves, in the galleries of Scolytids, or in the clusters of small fruits. Those on the fruits remained active to some extent, and all stages were found. That there was no true diapause in summer was confirmed in a test in August in which thrips placed on an olive twig standing in water reproduced normally, the life-cycle being completed in 26 days. Eggs laid in the first half of September gave rise to adults in about four weeks. These overwintered, as also did the second-instar nymphs and pupae from eggs laid later if the winter was mild, but younger stages were killed by the cold.

Natural enemies observed were an unidentified mite of the genus *Cheyletus*, which attacked the eggs, various predacious bugs, and *Tetrastichus gentilei* Del G., which parasitised the nymphs, but became active only in July, when the thrips were already abundant.

In preliminary laboratory experiments with the older insecticides, the best results were given by sprays of 0·03 per cent. nicotine with 0·5 per cent. soap, which proved effective against all stages, and by emulsions of 1 per cent. white oil or kerosene, which killed the adults and nymphs, but not the eggs. In further tests, proprietary sprays of DDT and BHC showed considerable promise.

[Vukasović (P.).] Вукасовић (П.). **The Control of the Bean Bruchid (*Acanthoscelides obtectus* Say) by Means of DDT and BHC.** [*In Serbian.*]—*Plant Prot.* no. 2 pp. 101–104, 7 refs. Belgrade, 1950.

In laboratory experiments in Yugoslavia in 1947, mixing DDT with stored beans at rates of 0·001 and 0·0025 per cent. by weight gave complete mortality in 6 and 2–3 days, respectively, of adults of *Bruchus* (*Acanthoscelides*) *obtectus* Say, and prevented further breeding. BHC gave similar results.

Günthart (E.). **Beiträge zur Lebensweise und Bekämpfung von *Ceuthorrhynchus quadridens* Panz. und *Ceuthorrhynchus napi* Gyll. mit Beobachtungen an weiteren Kohl- und Rapsschädlingen.** [Contributions to the Bionomics and Control of *C. quadridens* and *C. napi*, with Observations on further Pests of Cabbage and Rape.]—*Mitt. schweiz. ent. Ges.* **22** pt. 5 pp. 441–591, 41 figs., 12 pp. refs. Berne, 1949.

In view of serious injury to rape and varieties of cabbage near Zürich by *Ceuthorrhynchus quadridens* (Panz.) and *C. napi* Gylh., investigations on

these and other pests of the plants were carried out in 1945–48. The results are recorded in detail and compared with the European literature. Descriptions are given of the eggs, larvae, cocoons and adults of the two weevils and of the injury that they cause. Adults of *C. quadridens* were found overwintering in litter at the edges of woodland [*cf. R.A.E.*, A **10** 145]. They resumed activity when the temperature exceeded 10–12°C. [50–53·6°F.] and flew when it reached 15–16°C. [59–60·8°F.] in the shade. The females required a period of maturation feeding before pairing with the males. Young plants were preferred for feeding and oviposition, which occurred mainly in April–May, and after rape had flowered many of the weevils migrated to young cabbage. Eggs were deposited in batches of about four, most frequently in the tissue on the underside of the main leaf-vein or in the leaf-stalk. The larvae mined in the leaf-stalks and eventually entered the main stems of the plants, many of which were killed [*cf.* **30** 539]. An average of about 111 larvae and 10 egg-batches per plant were counted on winter rape in one area at the end of April 1947. Injury became particularly noticeable from early May to early June. On becoming full-fed, the larvae entered the soil and pupated in earthen cocoons close to the surface. Total development from egg to adult lasted about 70 and 59 days at average temperatures of 14·2 and 16·2°C. [57·6 and 61·2°F.], respectively. Newly emerged adults of both sexes were present in equal numbers on wild and cultivated crucifers in late June and early July and sought hibernation quarters about mid-July. The Ichneumonid, *Thersilochus melanogaster* Thoms., was found in 35–75 per cent. of the cocoons, and larvae of *Perilitus* sp. were observed in the abdomens of two of 30 females of *C. quadridens*.

C. napi becomes injurious to rape in Switzerland only when the areas cultivated are large or close together and is unlikely to reach outbreak numbers on cabbage alone, since on this only a few larvae develop in each plant. Its bionomics differed from those of *C. quadridens* mainly in that the newly emerged adults left their cocoons in winter but remained in the soil until spring, and that the eggs were deposited singly in the stems just beneath the growing tip [*cf.* **40** 323]. Within a few days of oviposition, gall formation and hollowing of the stem occurred, killing the young hearts of cabbage and causing excessive branching of rape. Total development lasted rather longer than for *C. quadridens*. Cocoons of *Thersilochus gibbus* Holmgr. were found in 30–40 per cent. of the cocoons of *C. napi*.

Briefer accounts are given of the bionomics of the other pests observed, which included eight other species of *Ceuthorrhynchus*, *Baris* spp., *Phyllotreta* spp., several Anthomyiids and Muscids, a few Dipterous leaf-miners and (on rape only) *Meligethes aeneus* (F.). Numerous laboratory, greenhouse and field experiments are described on the control of *C. quadridens* and *C. napi*, mostly with proprietary dusts and sprays of BHC and DDT, and the effects of some of the treatments on other pests are discussed. BHC was generally superior to DDT [*cf.* **39** 231], and the recommendations for its use comprise spraying or dusting cabbage seedlings every 10–14 days, beginning in late March or early April, for control of adults, eggs and larvae of *C. quadridens*, and dipping infested plants in the spray liquid when planting out. To prevent oviposition by *C. napi* on cabbage, treatment should be applied at intervals of 5–6 days as soon as the adults appear and repeated 4–5 times at similar intervals after planting out if infestation is heavy. Both pests can be controlled on winter rape by spraying with BHC when the new shoots are about an inch long (late March or early April) and again if necessary after 10–14 days, and this treatment also controls *Meligethes*.

Wiesmann (R.), Gasser (R.) & Grob (H.). **Versuch zur Bekämpfung des Maikäfers** (*Melolontha melolontha* **L.**) **durch Flugzeugbehandlung mit DDT-Stäubemittel.** [An Experiment on the Control of *M. melolontha* by dusting from an Aeroplane with DDT.]—*Mitt. schweiz. ent. Ges.* **23** pt. 1 pp. 1–36, 10 figs., 9 refs. Berne, 1950.

Wiesmann (R.) & Gasser (R.). **Fünf Jahre Erfahrungen in der Bekämpfung des Maikäfers** (*Melolontha melolontha* **L.**) **und Beobachtungen zu seiner Oekologie.** [Five Years' Experience in the Control of *M. melolontha* and Observations on its Ecology.]—*Z. PflKrankh.* **57** pt. 1–2 pp. 17–37, 8 figs., 56 refs. Ludwigsburg, 1950.

The first of these papers comprises a detailed account of a large-scale experiment in 1948 on the prevention of injury in pasture and cultivated land near Torny-le-Grand, in the Swiss canton of Fribourg, by larvae of *Melolontha melolontha* (L.), which had caused serious losses there in the two previous years, by applying a 5 per cent. DDT dust from an aeroplane to the surrounding woodland against the newly-emerged adults. The woodland consisted mainly of beech with some oaks and other trees, and bordered the experimental area on three sides. The majority of adults in soil samples taken in March and April were found about a foot beneath the surface, the population averaging 11·3 with a maximum of 59 per sq. yard. Emergence from the soil was studied by netting sample plots, and began on 20th April, reached peaks on 29th April and 5th–7th May and was completed by 20th May. Fruit trees and hedges in the area were sprayed with DDT during late April and early May, and the forest edge was dusted to a depth of about 65 yards on 7th May, the DDT being applied at about 2 lb. per acre. The aircraft and apparatus used are described. Weather conditions were favourable, and beetles began to fall from the trees after an hour. Very great numbers fell during the first two days, and others left the trees and flew to the fields. The latter included males and females, and the ovaries of the females were still undeveloped. Their fate was unknown. Heavy rain on 9th–10th May washed away most of the dust, and on 11th–12th further large numbers of beetles flew into the woods, so that in some areas the trees were completely defoliated in two days. Few adults were emerging from the soil at that time and anatomical investigations and flight observations showed that the beetles observed were either returning for secondary feeding [*cf. R.A.E.*, A **40** 188] or had left defoliated trees outside the treated area in search of food. The experimental area served as a natural trap for such individuals and many eggs were deposited in it, since the ovipositing females did not fly far or high enough to cross the belt of trees.

The success of the work was evaluated by examining soil samples in the autumn, when it was found that the numbers of larvae per sq. yard averaged 65·8 in the treated area and 46–58·3 in neighbouring untreated areas. It is concluded that a spray would have given better results, since the deposit would not have been washed away so readily by the rain. The treatment had no appreciable harmful effect on bees, forest insects or birds [*cf.* **39** 358] or on the fauna of streams or a stagnant pond in the treated area, though there was some mortality of frogs.

The second paper contains short accounts of the work leading up to the experiment at Torny-le-Grand, of that experiment itself, and of a similar one in Alsace in 1949 [*cf.* **41** 129]. The conditions under which the two main experiments were carried out and their results are compared, and observations on the flight of the beetles recorded. It is concluded that treatment is best carried out when not more than 10 per cent. of the females contain mature ovaries.

Since the beetles had been exposed to late frosts in Alsace, an experiment on cold-resistance was carried out in which field-collected adults of *M. melolontha* that had been kept at room temperature (20°C. [68°F.]) were transferred to −5, −8 or −12°C. [23, 17·6 or 10·4°F.], left for varying periods and then kept for an hour at 5°C. [41°F.], after which they were restored to room temperature and offered food. Males and females withstood exposure to −5 and −8°C. under dry conditions for eight hours, and many for 48 hours; exposure to −12°C. for eight hours was fatal, but not for one hour. It is concluded that normal late spring frosts would not be injurious.

Koenig (P.) & Koelle (G.). **Solanaceen als Wirtspflanzen des Kartoffelkäfers.** [Solanaceous Plants as Food-plants of the Potato Beetle.]—*Z. PflKrankh.* **57** pt. 5–6 pp. 172–177, 5 refs. Ludwigsburg, 1950.

Observations were made in 1945–49 on the occurrence of *Leptinotarsa decemlineata* (Say) on solanaceous plants growing at a research institute near Karlsruhe. Development occurred only on plants of the genera *Solanum*, *Hyoscyamus*, *Atropa* and, to a limited extent, *Nicotiana*, and *Capsicum*, *Physalis*, *Datura* and *Petunia* were not attacked. A list is given showing the 29 species that were infested, with the intensity of attack on each. Apart from potato, the only heavily infested species of *Solanum* of economic importance was egg-plant (*S. melongena*). Freshly-planted tomato seedlings were defoliated in 1948–49 and died, but older plants were largely immune. Infestation was heavy on *S. sisymbriifolium*, but attempts to use this plant to attract the beetles from potato were unsuccessful. Infestation of *Nicotiana* spp. appeared to be in inverse relation to the nicotine content. *A. belladonna* was heavily attacked in 1948, but not in 1949, when the plants of this species were moved away to a shady, wooded site.

In a brief discussion of the feeding preferences observed, it is stated that Hesse found that acetaldehyde was the attractant in potato leaves and that the resistant *S. chacoense* became attractive when treated with potato sap. Kuhn isolated an alkaloid termed demissin from the resistant *S. demissum* and found that potato leaves treated with it were not eaten by the larvae.

Blunck (H.). **Zur Kenntnis der Hyperparasiten von *Pieris brassicae* L. 5. Beitrag: *Hemiteles simillimus sulcatus*. Die Metamorphose.** [Contributions to the Knowledge of the Hyperparasites of *P. brassicae*. Fifth Contribution: *H. simillimus sulcatus*. Metamorphosis.]—*Z. angew. Ent.* **33** pt. 3 pp. 421–459, 43 figs., 14 refs. Berlin, 1952.

In this fifth part of a series on the parasites of *Apanteles glomeratus* (L.), which is itself a parasite of *Pieris brassicae* (L.), in Germany [*cf. R.A.E.*, A **41** 133, etc.], further information is given on *Hemiteles simillimus* var. *sulcatus* Blunck [**40** 280]. The immature stages of this Ichneumonid and the processes of hatching, moulting, pupation and adult emergence are described, and laboratory investigations on its development are recorded. The eggs are laid on the larvae of *A. glomeratus* in their cocoons, and the larvae feed ectoparasitically. Development was not affected when the parasitised hosts were removed from their cocoons, or when parasite eggs or larvae were transferred from one host larva to another, which facilitated laboratory rearing and prevented losses from superparasitism. At room temperature (averaging about 17°C. [62·6°F.]) the egg stage lasted 1–5 days, the first larval instar 3 days, the other four instars 1–2 days each, the prepupal stage 6–14 days, the pupal stage 8–11 days. It is not known how many generations there are a year. The Ichneumonid overwintered as larvae in cocoons, but resumed development at any

time when the laboratory was heated. As in several other parasites of *A. glomeratus*, adult emergence occurred chiefly in the morning, irrespective of light or temperature conditions.

Gösswald (K.). **Über Versuche zur Verwendung von Hilfsameisen zwecks Vermehrung der nützlichen Kleinen Roten Waldameise.** [Experiments on the Use of auxiliary Ants for propagating the useful Small Red Forest Ant.]—*Z. angew. Ent.* **34** pt. 1 pp. 1–44, 29 refs. Berlin, 1952.

Large numbers of queens of the small form (*minor*) of the red forest ant, *Formica rufa rufo-pratensis* Forel, can now be reared in a forest station set up in Germany for this purpose [*cf. R.A.E.*, A **41** 131], but workers are also needed for the foundation of new colonies. Detailed accounts are given of laboratory experiments undertaken in 1947 to discover whether workers of other *Formica* ants would adopt the queens and rear their progeny. The most promising results for practical purposes were obtained with workers of *Formica rufa rufa* L., *F.* (*Serviformica*) *fusca gagates* Latr., *F.* (*S.*) *fusca cinerea* Mayr and possibly *F. rufa pratensis* Retz. The queens were also readily adopted by other forms of subsp. *rufo-pratensis*, though not by form *minor* var. *pratensoides* Gössw. [*cf.* **40** 281]. Low temperatures favoured successful adoption. Queens were adopted only by groups of workers not already accompanied by their own queens, and more easily by small groups than by large ones, though once adoption was effected the number of workers could safely be progressively increased. Queens were more easily accepted in numbers than singly.

Thalenhorst (W.). **Das Auftreten von Kiefernbuschhornblattwespen in Norddeutschland 1949.** [The Occurrence of Pine Sawflies in North Germany in 1949.]—*Z. angew. Ent.* **34** pt. 1 pp. 45–64, 4 figs., 10 refs. Berlin, 1952.

Outbreaks of *Gilpinia* (*Diprion*) *frutetorum* (F.) and *Neodiprion* (*D.*) *sertifer* (Geoffr.) occurred in pine forests in many areas of northern Germany in 1949, and the distribution of infestation by the two species is shown on a map. *G. frutetorum* was studied principally in an area near Celle, where it was accompanied by small numbers of *Diprion pini* (L.), *Macrodiprion nemoralis* (Ensl.) (*D. nemorum* (F.)), *G.* (*D.*) *virens* Klug and *D. similis* (Htg.). Damage had been considerable there in the autumn of 1948, and an examination of the cocoons overwintering in the litter was made in January 1949. The results are given in detail and discussed. The two sexes were present in nearly equal proportions, and small percentages were parasitised. The main parasites reared were the Ichneumonid, *Hypsantyx impressus* (Grav.), the Tachinid, *Ceromasia inclusa* (Htg.) and the Eulophid, *Dahlbominus* (*Microplectron*) *fuscipennis* (Zett.). It was calculated from the data obtained that about 10,000 eggs would be laid per tree in the spring of 1949, and this forecast was confirmed by sample egg-counts in May. Egg parasites were of no practical importance and considerable damage was expected. The larval population was about 5,000 per tree at the end of May, but diseases reduced the number that pupated to about 2·6 per cent. of this figure. Parasitism of the cocoon stages by *D. fuscipennis* increased steadily throughout the summer, and few adults emerged. No eggs or larvae were found in September, and the trees recovered from the injury. In one section, DDT or BHC fogs were applied against the larvae in May. DDT proved satisfactory and superior to BHC, which was released under less favourable conditions.

N. sertifer overwinters in the egg stage and spins its cocoons in June. Investigation of these in various localities showed that females were generally more numerous than males. Parasitism of the cocoon stages increased throughout July–September, particularly that by *D. fuscipennis*, and mice destroyed up to 79 per cent. of the cocoons in some areas, but considerable numbers of adults emerged. Eggs were laid at rates of up to 7,600 per tree, with averages of over 2,000 in some places, and considerable local damage was forecast for 1950.

Mallach (N.). **Schädlingsbekämpfung mit chemischen Mitteln und Bienenzucht.** [Pest Control by chemical Means and Beekeeping.]—*PflSch. Wiss. Wirtsch.* no. 1, 52 pp., 146 refs. Munich, Bayer. Landwirtschaftsverlag, 1952. Price *DM.* 1.60.

This booklet contains sections on the toxicity to honey bees of the insecticides in general use in Germany, measures recommended for the protection of bees when treatment is applied against pests of plants, and steps that can be taken by beekeepers to reduce the likelihood of injury to their colonies. Information facilitating the detection of poisoning and a digest of the German legislation for the protection of bees from harmful insecticides are included.

Schreier (O.). **Über Auftreten und Bekämpfung der Zwiebelfliege (*Hylemyia antiqua* Meigen).** [On the Occurrence and Control of *H. antiqua*.]—*Pflanzenschutzberichte* **10** pt. 1–2 pp. 4–13, 12 refs. Vienna, 1953. (With a Summary in English.)

Hylemyia antiqua (Mg.) is the most important insect pest of onions in Austria. Observations on the course of infestation near Vienna in 1950–52 indicated that it has 3–4 overlapping generations a year, of which the first is the most injurious, the larvae being present in May and June, when the plants are young and easily killed. Some puparia from larvae collected in September gave rise to adults in October and others overwintered, the proportion overwintering increasing as the temperature at which they were kept was reduced from 24 to 5–8°C. [75·2 to 41–46·4°F.]. The Braconid, *Aphaereta cephalotes* (Hal.) emerged from a few of the puparia, and *Phygadeuon* sp. from one.

In tests on control, technical BHC applied to the seedlings before planting or mixed with the soil protected against infestation but caused tainting and was injurious to the plants [*cf. R.A.E.*, A **36** 156]. Proprietary sprays of parathion and γ BHC applied to infested seedlings gave good control, even when the larvae had entered the plants, but a DDT spray was ineffective. Disappointing results were obtained when the plants were sprayed or watered with the systemic insecticide Systox [O-(2-ethylmercapto)ethyl) O,O-diethyl thiophosphate].

Jacobson (M.). **Constituents of *Heliopsis* Species. II. Synthesis of Compounds related to Scabrin.**—*J. Amer. chem. Soc.* **74** pp. 3423–3424, 5 refs. Easton, Pa., 1952.

In view of the high toxicity of scabrin (the N-isobutylamide of an unsaturated 18-carbon straight-chain acid containing five double bonds) to houseflies [*Musca domestica* L.] [*cf. R.A.E.*, A **40** 7], the N-isobutylamides of several C_{18} acids with fewer double bonds were prepared and tested. All proved to be ineffective at high concentrations, causing little knockdown or mortality.

Speer (M.). **Observações relativas à biologia do " bicho mineiro das fôlhas do cafeeiro ", *Perileucoptera coffeella* (Guérin-Méneville) (Lepidoptera-Buccolatricidae).** [Observations on the Biology of the Coffee Leaf-miner, *Leucoptera coffeella*.]—*Arq. Inst. biol.* **19** pp. 31–47, 4 refs. São Paulo, 1950. (With a Summary in English.)

Further studies were made in São Paulo in 1947–48 on the bionomics of *Leucoptera (Perileucoptera) coffeella* (Guér.), a pest of coffee that is normally held in check by parasites but which causes considerable damage from time to time [*cf. R.A.E.*, A **33** 311]. In laboratory experiments at 20°C. [68°F.], adults from field-collected pupae survived for averages of 21–26 days when sugar or honey solution was provided in the tubes and 5–7 days with no food or water only. The females survived for averages of 1–5 days longer than the males, and pairing did not affect the length of life of either sex. When adults that had not paired were confined in cellophane bags on the coffee plants, they survived for averages of 11·6 days at 16°C. [60·8°F.], 9 days at 21°C. [69·8°F.], 7·5 days at 23·5°C. [74·3°F.] and 3·8 days at 27·5°C. [81·5°F.]. In a further field test at 21°C., males and females that had paired lived for averages of 7·9 and 7·7 days, respectively, and those that had not for 7·3 and 10·4 days. The most favourable daily average temperature for oviposition was about 22–26°C. [71·6–78·8°F.] Oviposition began 3–18 days after emergence, and the numbers of eggs laid per fertilised female varied from 3 to 90 and averaged 36. An average of seven eggs was laid per day. The egg stage lasted 5–21 days, depending on temperature, and 95·6 per cent. of the eggs hatched in summer and 77·2 per cent. in winter. The larval, prepupal and pupal stages lasted 9–42, 2–4 and 4–12 days, respectively. The complete life-cycle from oviposition to adult emergence varied from 25 to 77 days, according to temperature, and it is calculated that seven generations could develop in the field in a year. In field observations, varieties with tender leaves were the most heavily attacked, and *Coffea arabica* was preferred to *C. excelsa* or *C. robusta*.

da Fonseca (J. P.). **Experiências de combate químico a cupins subterrâneos no horto florestal de Guaraní.** [Experiments on the chemical Control of Subterranean Termites in the Forest Nurseries of Guaraní.]—*Arq. Inst. biol.* **19** pp. 57–84, 4 pls., 2 figs., 4 graphs, 2 refs. São Paulo, 1950. (With a Summary in English.)

Attempts begun in 1908 to establish plantations of *Eucalyptus* on certain areas with poor soil in the State of São Paulo, Brazil, have been greatly hindered by subterranean termites, especially *Syntermes insidians* Silv. and *S. molestus* (Burm.), which attack the root collars of the seedlings from the time of transplanting. Plants less than 8–10 months old are killed, but older ones survive the attack. Of a total of two million seedlings set out since the work began, about 70 per cent. have been destroyed in this way. Excavations in infested areas showed that *S. molestus* constructs convex cells, about 2 ins. high and 4 ins. wide, often at considerable depths and connected with each other and with the surface by narrow, tortuous galleries. Nothing is known of the habits of *S. insidians*.

Three series of experiments on chemical control were made in 1941–44. Most of the materials tested were applied, usually in soil, to the sides and bottoms of the holes in which the seedlings were to be set, and the roots of the latter were protected from contact with them by a layer of untreated soil; some of the chemicals were also applied to the surface round the stems. In all, some 25 mixtures were tested, at a rate of a little over 1 lb.

per plant. In the first series, promising results were given by 3 per cent. arsenic trioxide, lead arsenate or paris green mixed with soil, 4 per cent. arsenic trioxide in sawdust, and a mixture of 1 lb. tar distillate, 5 lb. slaked lime, 2·5 gals. water and 1 lb. copper sulphate, which was applied to the balls of soil surrounding the roots of the seedling and to the holes themselves. In the second series, 3 per cent. lead arsenate, arsenic trioxide or paris green in soil gave good results, though the differences between them were not significant, and treatments were as effective on unploughed as on ploughed land. Cardboard soaked in a repellent mixture of tar distillate, naphthalene and diesel oil and placed round the seedlings in the soil also proved fairly effective. In the third series, 3 per cent. arsenic trioxide or lead arsenate in fine soil and a repellent mixture of tar distillate, naphthalene and petrol reduced the percentage attack to 12·5–14·5, as compared with 60 per cent. for no treatment, with no significant difference between them, and were significantly superior to 5 per cent. naphthalene or 3 per cent. paris green in soil. In a final test in which various concentrations were compared in soil, the percentages of plants attacked were 4–8 for 2–4 per cent. arsenic trioxide, 10·5–22 for 1·5–4 per cent. lead arsenate and 6–12·5 for 2–4 per cent. paris green, as compared with 67, 58 and 44·5, respectively, for no treatment. From a consideration of comparative costs and effectiveness, treatment with 3 per cent. arsenic trioxide in soil is recommended.

Lepage (H. S.) & Giannotti (O.). **Ensaios com inseticidas orgânicos modernos e seu efeito sôbre as pragas do algodoeiro.** [Experiments on the Effect of modern organic Insecticides on Pests of Cotton.]—*Arq. Inst. biol.* **19** pp. 207–215, 1 fig., 5 refs. São Paulo, 1950. (With a Summary in English.)

Further studies were made in São Paulo in 1948–49 with synthetic organic insecticides against cotton pests [*cf. R.A.E.*, A **41** 12]. The insects causing most damage were *Eutinobothrus brasiliensis* (Hambleton) and *Aphis gossypii* Glov., and *Garganus* sp., *Lygus* sp. and *Horcias nobilellus* (Berg) were also present. The dusts used were 0·5 per cent. parathion, 10 per cent. chlordane, 3 per cent. γ BHC with 5 per cent. p,p′DDT and 40 per cent. sulphur, 20 per cent. toxaphene with 40 per cent. sulphur, and 0·5 per cent. parathion with 5 per cent. p,p′DDT. Five applications were made between 30th November and 15th February, and their effectiveness was assessed by the development and yield of the plants. The results, which are analysed statistically, showed that there were no significant differences between the products used, but that all caused highly significant increases in yield over the control plots.

Lepage (H. S.) & Giannotti (O.). **Atividade de alguns inseticidas modernos sôbre a broca do café—*Hypothenemus hampei* (Ferrari).** [The Action of some modern Insecticides on the Coffee Berry Borer, *Stephanoderes hampei*.]—*Arq. Inst. biol.* **19** pp. 299–308, 1 pl., 2 figs., 9 refs. São Paulo, 1950. (With a Summary in English.)

The authors state that as a result of previous work on the control of *Stephanoderes* (*Hypothenemus*) *hampei* (Ferr.) on coffee in São Paulo, Brazil [*cf. R.A.E.*, A **41** 12, etc.], dusts of 1 per cent. γ BHC are widely used there for the control of this pest, and describe experiments in 1948 on the comparative effectiveness of dusts of γ BHC, parathion, DDT, toxaphene and chlordane against the adults.

In the laboratory, petri dishes each containing five coffee berries inserted into holes in a rubber disk were dusted with various concentrations of the insecticides; 15 females were subsequently put into each dish, and mortality was recorded after 48 hours at 27–28°C. [80·6–82·4°F.]. Complete or almost complete mortality was given by 0·5 per cent. γ BHC or parathion, 5 per cent. DDT, 20 per cent. toxaphene and 10 per cent. chlordane, with no significant differences between them, whereas lower concentrations were less effective. In the field, dusts of 1 per cent. γ BHC or parathion, 10 per cent. DDT, 5 per cent. DDT with 0·5 per cent. parathion, and 10 per cent. chlordane were applied four times at intervals of 20–25 days, beginning on 21st October. The percentages of fruits attacked were 1·6, 8·5, 7·9, 7·3 and 3·9, respectively, as compared with 13·7 for no treatment, and the percentages of living insects found in the fruits were 0·7, 35·9, 17·4, 21·6 and 13, respectively, as compared with 41. The superiority of the γ BHC over the other materials was highly significant and appeared to indicate that it has some repellent as well as toxic effect.

Autuori (M.). **Contribuição para o conhecimento da saúva** (*Atta* **spp.—Hymenoptera-Formicidae**). **IV. O sauveiro depois da 1.ª revoada** (*Atta sexdens rubropilosa* **Forel, 1908**). [A Contribution to the Knowledge of *Atta* spp. IV. The Nest of *A. sexdens rubropilosa* after the first Nuptial Flight.]—*Arq. Inst. biol.* **18** pp. 39–70, 2 pls., 1 fig., 5 graphs. São Paulo, 1948. **V. Número de formas aladas e redução dos sauveiros iniciais.** [V. The Numbers of alate Forms and the Reduction of the incipient Nests.]—*Op. cit.* **19** pp. 325–331. 1950. (With Summaries in English.)

In the first of these parts of a series [*cf. R.A.E.*, A **32** 107, etc.], the author records further observations in São Paulo on a nest of *Atta sexdens rubropilosa* Forel that had been founded in November 1937 and from which the first nuptial flight took place in December 1940 [*cf.* **31** 478]. There were three subsequent nuptial flights, and the nest was enlarged after each. It had to be destroyed early in 1944, owing to the damage caused by the ants to the surrounding vegetation. When it was excavated, the fungus chambers were found in the newer half of the nest and the refuse chambers in the older half. The refuse collected was estimated to represent over six tons of fresh vegetable matter. The colonies of this ant are long-lived, one under observation being 14 years old. It has been kept in the laboratory for 12 years, but has produced no alates. In an experiment, it could not be induced to accept a queen other than its own.

In the second part, the author reports that the number of male and female alates found in various nests excavated just before the nuptial flight averaged 14,233 and 2,902 for *A. sexdens rubropilosa*, 5,362 and 1,688 for *A. bisphaerica* Forel, and 2,808 and 978 for *A. laevigata* (F. Sm.). Further investigations indicated that 97·5 per cent. of the queens died within 100 days after the nuptial flight and that at least 99·95 per cent. of the incipient colonies were destroyed by natural causes in the first 15 months, so that measures against the queens during and shortly after the flight are useless.

Vergani (A. R.). **La mosca del Mediterráneo** *Ceratitis capitata* (**Wied.**)—[*Publ. Inst. Sanid. veg.*] *Minst. Agric. Argent.* (B) **8** no. 22, 17 pp., 4 figs., 1 map. Buenos Aires, 1952.

Ceratitis capitata (Wied.) now occurs in all the fruit-growing districts of Argentina north of 36°S. lat. and attacks many fruits, though the larvae

do not develop in lemons, owing to the acidity of the juice and the toughness of the membranes, or in some varieties of grapefruit, owing to the thickness of the skin. The egg and larval stages last 2–7 and 12–15 days, respectively, and the pupal stage, which is passed in the soil or in the packing round fruits in boxes, lasts 12–15 days in summer and considerably longer in winter. The life-cycle is completed in about 30 days in summer and 60 in winter. The females normally feed for 4–7 days before ovipositing. In laboratory experiments, they died within four days without food, but survived for 7–8 months if food was provided. Females that had not oviposited did so normally after 4–5 months when suitable fruits were supplied. Methods of control comprise the disposal of infested fruits in pits [*cf. R.A.E.*, A **38** 395] and the use of bait-traps [*cf.* **30** 458; **38** 395], bait-sprays of 5 per cent. sugar or molasses with 0·15 per cent. sodium fluosilicate, sodium fluoride or sodium arsenite, the last mixture applied on straw or rags hung in the trees as it scorches the foliage, and sprays of DDT or BHC. Sprays of 2·5 lb. 50 per cent. DDT per 100 gals., applied at intervals of 20 days, gave good results in field tests but destroyed parasites of the fruit-fly. BHC gave rapid mortality but quickly lost its effectiveness and impaired the flavour of the fruits. *Tetrastichus giffardianus* Silv., which parasitises the larvae of *C. capitata*, has been introduced into Argentine [**38** 352] and attempts to rear it in the laboratory are in progress.

Laudani (H.) & Vanderford (H. T.). **Control of Little Black, Pharaoh and Argentine Ants . . .**—*Pest Control* **20** no. 5 pp. 18, 20, 22. Painesville, Ohio, 1952.

Tests were made in Savannah, Georgia, during the summer of 1950 on the control of *Iridomyrmex humilis* (Mayr), *Monomorium minimum* Buckl. and *M. pharaonis* (L.) in houses by means of sprays. The insecticides used were 2 per cent. chlordane, which was known to be effective against ants, 0·5 per cent. γ BHC as lindane, 5 per cent. DDT, and 0·1 per cent. pyrethrins or allethrin with 1 per cent. piperonyl butoxide, and they were applied in emulsions to the exterior of the houses and in oil solutions, which cause less staining, to the interiors. At least three houses were treated with each insecticide against each species, and if the initial treatments did not give control for the rest of the season, two more were made, and if these also failed, the ants were controlled with chlordane.

In the tests against *I. humilis*, the sprays were applied to the exteriors of the houses up to the level of the ground-floor windows, beneath the houses as far as possible, and to pillars, etc., forming bridges from the ground, where the ants nest, to the houses. Chlordane gave complete control for the season in two of three houses and for 17 weeks in the third. Applications of γ BHC were effective for 1–7 weeks on the exterior and for 3–7 weeks inside. DDT was effective for less than one week in two houses, but gave control for 15 and 14 weeks on the interior and exterior, respectively, of a third. The sprays of pyrethrins or allethrin with piperonyl butoxide gave temporary protection only, individual applications remaining effective for a maximum of 4 weeks.

In the tests against *M. minimum*, the sprays were applied to the exteriors of the houses and to the baseboards, door and window casings, etc., inside, to prevent the ants from entering. Chlordane gave complete protection throughout the season in two of three houses, and for 17 and 5 weeks on the inside and outside, respectively, of the third. DDT was effective for up to three weeks and BHC for up to seven, but pyrethrins and allethrin failed to protect for even one week. In the case of *M. pharaonis*,

which nests in a variety of places in and outside houses, the interior surfaces were extensively treated in addition to the exteriors. One application of chlordane gave protection throughout the season in three houses, but a further treatment was necessary in two others, and γ BHC was effective for 1–7 weeks indoors and 2–9 weeks outside. The other materials gave little or no control.

Beal (J. A.), Haliburton (W.) & Knight (F. B.). **Forest Insects of the Southeast: with special Reference to Species occurring in the Piedmont Plateau of North Carolina.**—*Bull. Sch. For. Duke Univ.* no. 14, xiv + 168 pp., 34 pls., refs. Durham, N.C., 1952. Price $2.50.

This bulletin, which is based in part on the literature, contains information on the insects of actual or potential economic importance to forest trees, timber and timber products in the Piedmont Plateau of North Carolina, many of which occur throughout most of south-eastern United States. The greater part of it is devoted to notes on their appearance, bionomics and control arranged according to the part, age or condition of the tree attacked or the method of feeding and including for some species records of parasites, predators and associated insects. An introductory chapter contains general accounts of the composition of the forests in the area under consideration, the conditions that favour insect attack in forests, the extent of the losses caused by it in the United States, and the factors that affect insect abundance, and general information on control, chiefly by chemical methods, is given in another chapter. A brief account of the purpose and value of forest surveys and procedures for conducting them and lists of the insects dealt with arranged under the trees attacked are also included.

Edwards (F. I.) & Cueto (C.). **Estimation of Pyrethrins on coated Paper Bags.**—*Analyt. Chem.* **24** no. 8 pp. 1357–1359, 1 fig., 2 refs. Easton, Pa., 1952.

The use of paper bags that have been treated with pyrethrum for protecting stored foods against insects has necessitated the development of an analytical procedure for estimating the content of pyrethrins in the coatings, both for observations in manufacture and for investigating the stability of the pyrethrins during storage of the bags. A method is described by which the pyrethrum is extracted from the paper with ethyl alcohol at 100–120°C. for three hours and treated with Skellysolve F to separate the pyrethrins from insecticidally inert related compounds extracted with them. The pyrethrins are allowed to react with hydroxylamine to form a hydroxamic acid, and this, on reaction with ferric chloride, produces a coloured complex that can be evaluated in a colorimeter. The difficulties encountered are discussed; extraction of pyrethrins from the paper was a major one, but the method finally evolved resulted in 97–100 per cent. recovery in 11 tests on paper coated with known amounts of pyrethrins and gave results consistent with the manufacturers' claim for a commercially treated paper. The results of analyses without the Skellysolve F extraction indicated the presence of large amounts of interfering substances. The uncoated paper showed a slight colour development even after extraction with Skellysolve F, and it is desirable to carry out a comparative analysis of untreated paper of the same origin as the treated bags whenever possible.

ENTOMOLOGICAL LITERATURE

LARGEST STOCK IN THE WORLD

of Books, Serials and Pamphlets, in all Languages, relating to INSECTS, SPIDERS, MITES and TICKS.

CATALOGUES ON APPLICATION

Liberal allowances in cash or exchange will be made for authors' reprints, and other works of entomological interest.

JOHN D. SHERMAN, Jr.
132 PRIMROSE AVENUE
MOUNT VERNON, NEW YORK

A REVIEW OF LITERATURE

ON

SOIL INSECTICIDES

By H. C. GOUGH, Ph.D.

Royal 8vo. Pp. iv and 161. Paper covers. Price **10s. 0d.** post free.
1945

Orders should be addressed to :—
THE DIRECTOR,
COMMONWEALTH INSTITUTE OF ENTOMOLOGY
41, Queen's Gate, London, S.W.7

Now Ready

LIST OF SUGAR CANE INSECTS

by

H. E. BOX, F.R.E.S., F.R.G.S.

Roy. 8vo. **v and 101 pp.** **Price 15s. (U.S. $2.25)**
Post free

The first part of this work is a catalogue of the insects and mites that have been recorded on sugar-cane. It is in three columns; the first is a list of the pests in systematic order and of their synonyms, and the other two show the countries in which they have been recorded on sugar-cane, and, if known, the parasites and predators that attack them.

The second part is a similar catalogue of the parasites and predators; it shows their hosts, the countries in which they attack particular hosts, and those into which they have been introduced.

A bibliography of the principal works consulted, and indexes to countries and genera are given.

Orders should be addressed to the Director, Commonwealth Institute of Entomology, 41, Queen's Gate, London, S.W.7.

The Injurious Insects of the British Commonwealth

(except the British Isles, India and Pakistan).

By J. W. EVANS, M.A., Sc.D., D.Sc.

Royal 8vo. vii and 242 pp. Bound in cloth. Price 30*s*. post free.

This work consists of five parts:—

Part 1 gives a brief outline of the environmental conditions and principal crops of each country in the Commonwealth followed by titles of comprehensive publications and a list of the more important insect pests of plants. Insects and ticks of medical and veterinary importance are also briefly discussed.

Part 2 consists of the more important plant pests and their distribution, listed under the crops arranged in alphabetical order.

Part 3 comprises the insects arranged in alphabetical order of genera and species under their respective orders with brief information and references relating to each insect.

Part 4 deals with weed control by insects and is arranged under the weeds in alphabetical order.

Part 5 deals very briefly with plant quarantine, virus vectors, insect control and research needs.

Orders should be addressed to **The Director, Commonwealth Institute of Entomology, 41, Queen's Gate, London, S.W.7.**

INDEX OF AUTHORS

ANON., 228.
Albrecht, F. O., 235.
Ankersmit, G. W., 232.
Asem, M. A., 229.
Autuori, M., 254.

Beal, J. A., 256.
Bennett, S. H., 234.
Blanka, A., 244.
Bletchly, J. D., 231.
Blunck, H., 249.
Bond, J. A. B., 237.
Braun, H., 228.
Busnel, M. C., 233.
Busnel, R. G., 233.
Bytinski-Salz, H., 230.

Carayon, J., 225.
Carli, E., 243.
Ceballos, G., 230.
Chant, D. A., 226.
Crooke, M., 236.
Cueto, C., 256.

da Fonseca, J. P., 252.
de Mol van Oud Loosdrecht, W. E., 235
De Rosa, T., 243.
Di Martino, E., 242, 244.
Dove, W. E., 234.
Downes, J. A., 226.
Duffy, E. A. J., 237.

Edwards, F. I., 256.
el Mistikawi, Abd el Megid, 231.
el Zoheiry, M. S., 229.

Ferrière, C., 229.

Gasser, R., 248.
Gay, F. J., 226.
Giannotti, O., 253
Gösswald, K., 250.
Grandori, R., 233.
Greaves, T., 226.
Grob, H., 248.
Günthart, E., 246.

Haliburton, W., 256.
Hall, D. W., 237.
Hase, A., 230.
Howe, R. W., 237.

Jacobson, M., 251.
Jannone, G., 241.

Knight, F. B., 256.
Koelle, G., 249.
Koenig, P., 249.

Laudani, H., 255.
Lepage, H. S., 253.
Lower, H. F., 228.
Lupo, V., 240.

McLeod, J. H., 226.
Mallach, N., 251.
Manzoni, G., 243.
Mukerjea, T. D., 239.

Neumark, S., 230.

Panjan, M., 245.
Pennisi, L., 242.
Pieri, G., 243.

Ratcliffe, F. N., 226.
Régnier, R., 231.
Riehm, E., 228.
Risbec, J., 225.
Rivnay, E., 229.
Roberti, D., 240.
Rozsypal, J., 230.

Schreier, O., 251.
Speer, M., 252.

Thalenhorst, W., 250.
Thomas, W. D. E., 234.
Tominic, A., 245.
Turica, A., 227.

Vanderford, H. T., 255.
Vasic, K., 244.
Vekemans, J., 235.
Vergani, A. R., 254.
Vukasovic, P., 246.

Weidner, H., 232.
Wiesmann, R., 248.
Williams, D., 226.
Williams, G., 238.

Zarco, E., 230.

NOTICES

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Director. Authors of papers on economic entomology, whether published in entomological journals or not, are invited to send reprints to the Director for notice in the *Review*.

The Executive Council of the Commonwealth Agricultural Bureaux is a signatory to the Fair Copying Declaration, details of which can be obtained from the Royal Society, Burlington House, London, W.1.

The Annual Subscription, *in advance*, to Volume 41 of the *Review* Series A (Agricultural) is 40s. post free (5.60 Can. or U.S. dollars): Series B (Medical and Veterinary), 20s. post free (2.80 Can. or U.S. dollars). Prices of Back Volumes on application.

Orders and Subscriptions should be sent to the Director, Commonwealth Institute of Entomology, 41, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS

	PAGE
AFRICA, EAST: The Breeding of *Nomadacris septemfasciata* in Captivity	235
AFRICA, EAST: A Systemic Insecticide against a Coffee Mealybug	237
AFRICA, EAST: Notes on injurious and beneficial Insects in Eritrea	241
AFRICA, FRENCH WEST: *Helopeltis* spp. on *Cinchona*	225
AFRICA, FRENCH WEST: Chalcidoid and Braconid Parasites of Pests	225
AFRICA, WEST: The Uses of Parathion in the Belgian Congo	235
AFRICA, WEST: Observations on Cacao Mirids in the Gold Coast	238
ARGENTINA: The Bionomics of *Cydia pomonella* in the Paraná Delta	227
ARGENTINA: The Bionomics and Control of *Ceratitis capitata*	254
AUSTRALIA: A Handbook on the Termites (*Review*)	226
AUSTRALIA: A Revision of the Jassids previously referred to *Empoasca*	228
AUSTRIA: The Bionomics and Control of *Hylemyia antiqua* on Onion	251
BRAZIL: Observations on *Leucoptera coffeella*	252
BRAZIL: The Control of Termites attacking *Eucalyptus* Seedlings	252
BRAZIL: Tests of Dusts against Cotton Insects	253
BRAZIL: A Comparison of Dusts against *Stephanoderes hampei* on Coffee	253
BRAZIL: Observations on the Nests of *Atta* spp.	254
BRITAIN: Studies on Oviposition and Hatching in *Anobium punctatum*	231
BRITAIN: The Bionomics of *Anoplonyx destructor* on Larch	236
BRITAIN: Damage to the Lead of a Cable by *Ptinus tectus*	237
BRITAIN: A revised Key to the Larvae of Ptinids	237
CANADA: Daily Abundance of *Forficula auricularia* and Weather	226
CZECHOSLOVAKIA: *Dyspessa ulula* as a Pest of Garlic	230
EGYPT: The Food-plants and Bionomics of *Crocidosema plebeiana*	229
EGYPT: Tests of Insecticides against *Prodenia litura* on Cotton	231
FRANCE: An Agromyzid damaging Poplar Wood for Cheese Boxes	231
FRANCE: Infra-red Rays for the Control of Insects in Chestnuts	233
GERMANY: Pests of Crops and their Control (*Review*)	228
GERMANY: *Bruchus obtectus* as a Pest of Field Beans	230
GERMANY: *Reticulitermes flavipes* damaging structural Timbers in Hamburg	232
GERMANY: The Food Preferences of *Leptinotarsa decemlineata*	249
GERMANY: The Bionomics of a Hyperparasite of *Pieris brassicae*	249
GERMANY: Adoption of Queens of the Small Red Forest Ant	250
GERMANY: Outbreaks of two Pine Sawflies	250
GERMANY: Protection of Bees from harmful Insecticides (*Review*)	251
HOLLAND: A Treatment against *Merodon equestris* in Daffodil Bulbs	235
INDONESIA: The Food-plants of *Phaedonia inclusa* in Java	232
ISRAEL: The Threshold of Reproduction in Insects	229
ISRAEL: *Phoracantha semipunctata* damaging *Eucalyptus*	230
ITALY: Bentomite controlling Insects in Stored Grain	233
ITALY: *Hoplocampa rutilicornis* on Plum and its Control	240
ITALY: The Bionomics and Control of *Anomala ausonia neapolitana*	240
ITALY: Parathion against *Planococcus citri* on Vines	243
SICILY: DDT Sprays against *Ceratitis capitata* on *Citrus*	242
SICILY: An Eriophyid infesting *Citrus*	244
SPAIN: *Lymantria monacha* on Pine and its Control	230
SWITZERLAND: The Parasites of *Lyonetia clerkella* on Apple	229
SWITZERLAND: The Bionomics and Control of *Ceuthorrhynchus* spp. on Crucifers	246
SWITZERLAND: The Control of *Melolontha* by Treatment against Adults	248
U.S.A.: Uses of Piperonyl Butoxide and Pyrethrins against stored-product Pests	234
U.S.A.: Tests of Spray Deposits against Ants in Houses	255
U.S.A.: Forest Insects in North Carolina (*Review*)	256
YUGOSLAVIA: A Survey of the Parasites of *Lymantria dispar*	244
YUGOSLAVIA: Tests of DDT and BHC against Wireworms	244
YUGOSLAVIA: A Virus Disease of Tomato and its Control	245
YUGOSLAVIA: The Bionomics and Control of *Liothrips oleae* on Olive	245
YUGOSLAVIA: The Control of *Bruchus obtectus* in stored Beans	246
The Insects attacking dried Roots of *Lonchocarpus* and *Derris*	226
Transactions of the IXth International Congress of Entomology	228
Absorption and Fate of Schradan in Plants	234
Changes in Susceptibility of Stages of Insects to DDT and Pyrethrins	239
Lack of Insecticidal Activity in Compounds related to Scabrin	251
Estimation of Pyrethrins on coated Paper Bags	256

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE
by The Eastern Press, Ltd., Reading.

(1860) Wt. P9/3884 10/53 E.P. Ltd. Gp. 565 [A]